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**УЧЕБНОЕ ПОСОБИЕ  
ПО СПЕЦИАЛЬНОМУ УХОДУ  
ЗА БОЛЬНЫМИ**

Издательство «Медицина» Москва

# NURSE'S HAND- BOOK

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# Contents

## PREFACE 7

## SKIN AND VENEREAL DISEASES 9

	The Structure and Function of the Skin	11
	Symptoms of Skin and Venereal Diseases	19
Chapter 1	SKIN DISEASES	27
	Causes of Skin Diseases	27
	Basic Principles of Treating Patients with Skin Diseases	29
	Pyodermitis	50
	Mycoses	61
	Trichophytosis, Microsporia, and Favus	68
	Laboratory Diagnosis of Dermatomycoses	74
	Candidiases	80
	Skin Diseases Caused by Animal Parasites	84
	Tuberculosis of the Skin	89
	Leprosy	93
	Lupus Erythematosus	95
	Dermatitis and Toxicoderma	97
	Eczema	99
	Occupational Diseases of the Skin	102
	Itching Diseases of the Skin	103
	Psoriasis	106
	Lichen Planus	108
	Pityriasis Rosea	109
	Vesicular Dermatitides	110
	Diseases of the Cutaneous Glands	113
	Malignant Tumours of the Skin	114
Chapter 2	VENEREAL DISEASES	116
	Syphilis	116
	Gonorrhoea	137
	Trichomoniasis	148
	Soft Chancre	149
	DISEASES OF THE EAR, NOSE, AND THROAT	155
Chapter 1	DISEASES OF THE NOSE AND PARANASAL SINUSES	155
Chapter 2	DISEASES OF THE PHARYNX	180
Chapter 3	DISEASES OF THE LARYNX, TRACHEA, AND CERVICAL OESOPHAGUS	198
Chapter 4	DISEASES OF THE EAR	225



## DISEASES OF THE EYE 247

Chapter 1	VISUAL FUNCTION AND METHODS OF ITS EXAMINATION	257
Chapter 2	EYE REFRACTION AND CORRECTING GLASSES	267
Chapter 3	OPHTHALMOLOGICAL NURSE	273
Chapter 4	EXAMINATION OF PATIENTS WITH DISEASES OF THE EYE	287
Chapter 5	BASIC METHODS OF TREATING DISEASES OF THE EYE	296
Chapter 6	DISEASES OF THE EYELIDS AND THE LACRIMAL APPARATUS	310
Chapter 7	CONJUNCTIVITIS	316
Chapter 8	DISEASES OF THE CORNEA AND SCLERA	330
Chapter 9	DISEASES OF THE LENS AND THE UVEA	338
Chapter 10	DISEASES OF THE RETINA AND THE OPTIC NERVE	344
Chapter 11	GLAUCOMA	349
Chapter 12	DISEASES OF THE OCULOMOTOR APPARATUS OF THE EYE AND THE ORBIT	356
Chapter 13	FIRST AID IN INJURIES OF THE EYE	358
Chapter 14	DISEASES OF THE EYE IN HOT CLIMATES	367
	SUBJECT INDEX	373

## Preface

This book describes venereal diseases and the diseases of the skin, ear, nose, throat and the eye from the stand point of modern medical science and in the scope necessary for training a medical nurse. The book also incorporates a special chapter describing diseases that would normally occur in countries with hot climates.

Training a medical nurse is an important problem. Unless adequately trained a medical nurse would be unable to give the necessary assistance to the doctor in his work aimed at prophylaxis and treatment of many diseases. Moreover, at certain areas a medical nurse may be the only representative of the medical science and she would therefore be obliged not only to give first aid to the injured or carry out prophylactic measures among population, but also treat diseases and even establish diagnosis. The authors of this book did not therefore limit themselves to instructing the future nurse how to take care of patients and take prophylactic measures, but also gave detailed descriptions of the diseases and their first signs which is very important for early and timely diagnostication.

Great deal of attention is given in this book to manipulations and operations connected with care of patients and giving them first aid, in emergency cases in particular. In contrast to usual textbooks intended for nurse schools, this book is richly illustrated which will help the student master the difficult profession of a nurse.

The terminology in the textbook complies with the new *Nomina Anatomica* adopted in 1955 and 1960 and all definitions are also given in the NA terms. The medicinal preparations and their dosage are given in compliance with the Soviet State Pharmacopoeia (10th edition).

The textbook has been compiled in accordance with the programme adopted by the Ministry of Health of the USSR with the addition of a special chapter describing the diseases encountered in hot climates.

# SKIN AND VENEREAL DISEASES

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Diseases of the skin are caused by various disorders in the function of the internal organs, endocrine glands, and especially of the nervous system. Skin diseases are often provoked by improper use of medicines and by the action of various agents on the skin or the entire body. In some patients the diseases of the skin are occupational in their character. Some diseases are contagious and prophylactic measures are therefore important to prevent their propagation among population. Some disorders of the skin are determined genetically (genodermatoses).

A nurse should be well acquainted with symptoms of skin diseases and be able to give all possible aid and care to patients (sometimes patients in grave condition). She must be able to treat (guided by the physician) patients with skin diseases.

The importance of *word* as a medicinal factor has been known for long and the nurse should be aware of this importance when she treats and takes care of patients. Her benevolent attitude to them, quieting and optimistic behaviour will favour reconvalence of her patients.

Special attention should be paid to *prophylaxis* of skin and venereal diseases. A medical nurse should take an active part in measures connected with prevention and control of venereal and skin diseases.

Venereal diseases are also known as social, because they are transmitted from person to person during everyday contacts.

Much work has been done in the Soviet Union and other socialist countries to eradicate the social causes of venereal diseases, but the diseases still occur and the medical workers must be well acquainted with their symptoms, the routes by which they are transmitted from one person to another,

and be able to give all possible aid. The duty of a medical worker is to remove the psychic stress from the patient with a venereal disease and to make him believe that the disease is curable. The patient should however be informed of the grave consequences that may follow if the disease is not treated properly.

Medical aid is readily available in this country, it is free of charge and given by highly skilled physicians. This factor, and also prophylactic measures, will ensure effective control of venereal diseases.

# The Structure and Function of the Skin

Skin is the outer covering of the human body. In the region of the natural orifices, viz., the mouth, nose, urogenital organs and the anus, the skin turns into mucosa. The surface area of the skin of an adult is from 1.5 to 2 square metres.

## ANATOMY OF THE SKIN

The skin consists of three layers: (1) epidermis, the outer layer, (2) corium, or dermis, and (3) subcutaneous connective tissue or hypodermis (deeper part of the skin) (Plate 1). The embryogenesis of these layers is different. Epidermis develops from the ectoderm (the outermost germ layer of the embryo), while the corium and subcutaneous connective tissue, from the mesoderm (the middle layer of the embryo). Epidermis is the epithelial tissue consisting of five layers: (1) basal layer (stratum basale), (2) spinous layer (stratum spinosum), (3) granular layer (stratum granulosum or layer of Langerhans), (4) clear layer (stratum lucidum or layer of Oehl), and (5) horny layer (stratum corneum) (Fig. 1). The epidermis does not contain blood vessels and the nutrients are carried to it by the lymph; the epidermis invests many nerve endings.

The *basal cell layer* is the deepest of all other epidermic layers. It borders with the corium (dermis) and is composed of one row of columnar cells. Epidermis cells are reproduced here. The basal cells contain grains of the brown pigment, melanin. The colour of the skin depends on the amount of this pigment contained in the basal cells. Residents of the torrid zone contain considerable amounts of melanin in their skin. Quantities of melanin differ in various parts of the skin of one man too. Melanin protects the human body

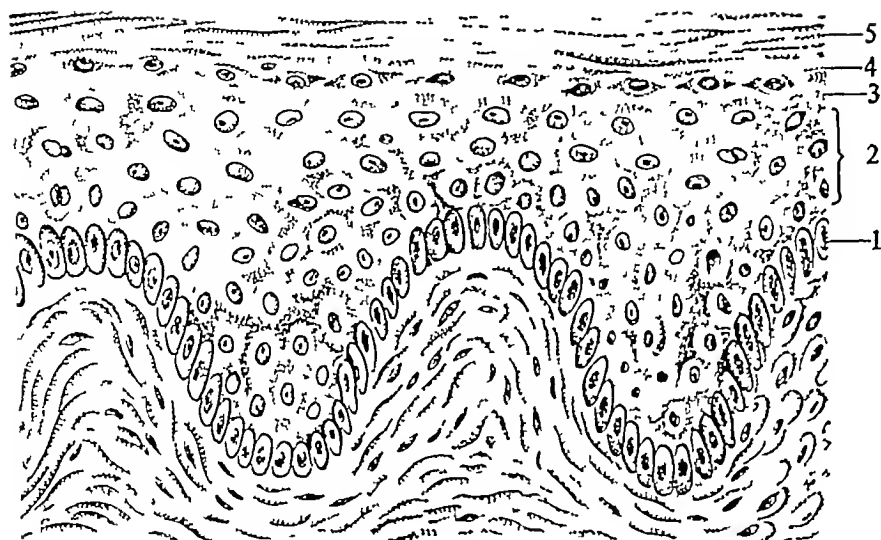


Fig 1 Section of the epidermis

from the harmful action of ultra-violet rays on the cell nuclei and deeper tissues

The *spinous layer* overlies the basal cell layer and consists of five or six layers of cube-shaped cells with light nuclei. These cells are connected between themselves and with the cells of the basal layer through intercellular bridges (intercellular ponticulus). The epithelial lymph carrying the nutrients to the cells and removing the metabolites from them passes in the space between the intercellular bridges and through interepithelial canals.

The *granular layer* is composed of one or two rows of oblong (rhomboid) cells containing light oblong nuclei. The protoplasm of these cells contains many grains of special protein, keratohyaline, the initial product of hornifying epidermic cells.

The *layer of Oehl*, or the stratum lucidum, overlying the granular layer, comprises one or two rows of flat cells free from nuclei, their protoplasm contains eleidin, the protein formed during further cornification of the epidermic cells.

The *horny layer* consists of five or six (to 10-15 on the palms and soles) layers of thin corny flattened cells free from nuclei.

and consisting of keratin, the final product of the cornification process. The ties between the cells decrease in the direction to the skin surface. The outer layer of the cells is gradually thrown (scaled) off.

The corium, or dermis consists of the papillary and reticular layers. The epidermis is held tight to the corium by rounded formations between which the papillae of the corium enter to ensure fast anchorage of the epidermis to the corium. The interphase between the epidermis and the corium is therefore wavy. The corium consists of connective tissue fibres, the main intercellular substance, and cells. The corium contains only small amounts of cell elements (histiocytes, fibrocytes, etc.). Connective tissue fibres form bundles which interlace in all directions to account for elasticity, firmness and strength of the skin. The main intercellular substance fills the space between the fibres and the cells and performs important physiological functions, it is actively involved in inflammatory and allergic changes in the skin, takes part in the metabolism, and prevents penetration of pathogenic microbes through the skin. The basal membrane is a conventional border between the epidermis and the corium. Its fibres are connected with the cells of the lower epidermic layers on the one side and are interlaced with the corium fibres, on the other. The vascular plexus is found in between the corium and the hypoderm.

The subcutaneous connective tissue, or the hypoderm, is composed of bundles of connective tissue fibres that form a kind of a network whose loops are filled with accumulations of fat cells.

The blood and lymph vessels of the skin form superficial and deep networks which ramify in the perpendicular and horizontal planes. Lymph and veins course parallel to the arteries.

The blood vessels and their minute rami deliver nutrition to the skin tissues and remove the metabolites from them. The lumen of the vessels varies depending on the ambient temperature, and is also changed by mechanical and chemical stimuli, and also by nervous or psychic effects (delight, distress, anger, etc.). The vessels may narrow or dilate to make the skin look pallid or red.

The skin of a child is characterized by the abundance of ves-



sels, tenderness, looseness, high moisture content, marked deposits of subcutaneous fat cells, increased permeability of the vessels and the tissues (hence frequent incidence of allergy and its comparative gravity in children), insufficient differentiation of cell elements and connective tissue fibres. The skin of a child macerates more readily than in the adult.

**Sweat glands.** Their number in the human body is as great as three million (and over). They excrete from 300-500 to 700-800 ml of sweat daily. In unfavourable conditions the amount of perspiration may be over 1 500 ml. The glands have a tubular structure and consist of a coiled body and the outlet duct. The coiled body, or glomerulus (the secretory portion of the gland) is situated in the hypodermis, while the outlet duct passes through the entire depth of the corium and opens on the skin surface. The palms, the soles and the face are especially rich in sweat glands. They are absent on the glans penis, the inner surface of the foreskin and the outer surface of labia minora. These are common *eccrine* glands. There is a group of other glands known as *apocrine* sweat glands which are found on the skin of the arm pits, genitalia, round the breast nipples and the anus. These glands are larger and open on the upper part of the hair follicles. Their function is connected with the function of the sex glands and begins with maturation.

**Sebaceous glands** have a lobular structure. They are found round the hair follicles (6 to 8 sebaceous glands round each follicle) and their ducts open onto the upper third of the follicle. Less frequently they open on the skin surface. The head, face, and the upper part of the back are especially rich in sebaceous glands. All skin glands are abundant with vessels and nerve endings that are found in connective tissue capsules.

**Hairs** found on the human body are differentiated into *long* hair of the head, hair of the beard, axillary hair and pubic hair, *coarse* hair of the brows, eyelids, nostrils and the external meatus of the ear, and *lanugo*, the soft hair found on the trunk and the extremities. Extending above the surface of the skin is the cylindrical shaft of the hair, while the root is contained in the *hair follicle* in the corium. The flask-shaped lower part of the root is known as the *bulb*.

(the site of hair cell multiplication) which rests on the *hair papilla* (containing blood vessels delivering nutrition to the hair and nerve fibres) Long hair consists of the central portion, the medulla, and the outer layer, the cortex The sheath of the hair is known as a cuticle The hair grows slowly and its length only increases 0.3-0.5 mm a day Sebaceous glands open on the upper part of the hair follicle

**Muscles of the skin** Smooth, involuntary muscles of the skin are those raising hair, and the muscles in the walls of the vessels and sweat glands When the hair levator muscle contracts, the hair straightens and expresses the secretion of the sebaceous gland Striated muscles of the skin are found on the face, these muscles, known as mimic, account for the expression of the face

**Nails.** A nail is a dense horny plate with a lustrous outer coating It rests in the bed limited on the sides and the base by nail folds The nail plate has the root, the body and the free border The part of the nail plate found beneath the posterior nail fold is the site from which the nail grows

**Nerves of the skin.** The skin is richly supplied with nerve fibres, endings, and special sensory terminals Nerve cells ramifying from the nerve plexus in the subcutaneous connective tissue, pass to hair follicles, sweat and sebaceous glands, to the muscles and the vessels of the skin, etc The skin is abundant with nerves and special sensory terminals which respond to various stimuli (pain, cold, heat, pressure, etc) Sweat and sebaceous glands, hair and nails are appendages of the skin

### *Review Questions\**

- 1 Name the layers of the skin (1), (2), (3)
- 2 Name the layers of the epidermis
- 3 What is the conventional border between the epidermis and the corium? (1) vascular network or (2) basal membrane?
- 4 What part of the human body is especially rich in sebaceous glands? (1) head, (2) hands, (3) face, (4) abdomen, (5) upper part of the back, (6) scrotum?
- 5 What kinds of hair do you know? (1), (2), (3)

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\* Students should either choose answers from those suggested to their consideration, or name the appropriate number (given in parentheses) Correct answers are given at the end of the section

## PHYSIOLOGY OF THE SKIN

The skin and its appendages are the organ that separates the internal medium of the body from the external environments and performs many vital functions. The skin is connected with the organism through the nervous system, circulating blood, and the glands of internal secretion. The skin is involved in the protein, fat, carbohydrate, water-salt and vitamin metabolism.

**Protective function.** The skin protects the body from unfavourable effects of the environment. A dense horny layer, firm and resilient fibres, and the subcutaneous connective tissue protect the body from mechanical (blows, friction, pressure, etc.), physical (high and low temperatures, etc.) and chemical effects. The water-and-fat cover of the skin reacts acid to preclude the ingress of microorganisms and to attenuate or neutralize completely the effects of chemical substances. The secretion of the sebaceous and sweat glands has bactericidal properties. The continuous desquamation of the outermost layers of the horny cells maintains the neutralizing effect of the skin. The pigment melanin, formed by the epidermic cells, protects the basal cell layer from sun rays and other radiation. Heat conductivity of the skin is low and this protects the body from excess heat or cold.

The reactivity of the skin and also the immune forces of the body add to the protective function of the skin. Children and adults with chronic diseases of the internal organs and the nervous system have lowered immunity and altered (increased or reduced) reactivity of the skin to the effect of easier infection with many skin diseases (e.g. pyodermitis). The course of these diseases is also different in these patients.

**The skin as the sensory organ.** The skin contains many nerve endings and sensory terminals and therefore it perceives and transmits various external stimuli to the central nervous system. The external stimuli ('signals') are perceived by the cerebral cortex as pain, pressure, heat, cold, etc. The sense organs of man (visual, hearing, olfactory), together with the sense of touch of the skin, help him orienting in space.

**The secretory and excretory function of the skin** The sebaceous and sweat glands of the skin produce organic and inorganic substances, the products of mineral metabolism, carbohydrates, vitamins, hormones, enzymes, and much water. The skin thus takes part in the *metabolism*. In conditions of exhausting work, fever, and at high ambient temperature, from 2 to 4 litres of sweat may be liberated instead of the normal 300-800 ml. Every day the sebaceous glands excrete about 20 g of fat.

Sweat glands remain underdeveloped in children and moisture is therefore liberated mainly through the entire surface of the skin. This becomes possible due to the thin horny layer of the epidermis and dilated lymph and blood vessels with increased permeability of their walls. Abundance of moisture and mineral substances in the skin of a child promotes more intensive metabolism in the cells, connective tissue, and in the intercellular substance of the skin.

**Respiratory and absorbing function of the skin.** A certain amount of oxygen is absorbed by the body through the skin and carbon dioxide and water vapour are liberated through it to the environment. This adds to the respiratory function of the lungs.  $\frac{1}{180}$  oxygen is absorbed and  $\frac{1}{90}$  carbon dioxide is liberated (compared with the lung metabolism). The contribution of the skin to the respiratory function is greater in children. Water and solids are almost not absorbed through intact skin. Certain chemicals and medicines (ether, chloroform, salicylic acid, iodine, corrosive sublimate, and some others) are easier absorbed.

**The thermoregulatory function of the skin** is controlled by the central nervous system. Heat emission of the skin increases when the blood vessels are dilated and sweating is intensified, and decreases with narrowing lumen of the vessels and decreased perspiration. Heat exchange of the body with the environment is effected through the skin.

### Review Questions

6 Name the main functions of the skin (1), (2), (3), (4), (5), (6)

7 What quantity of fat does the skin of an adult liberate every day?

## CARE OF THE SKIN

Proper care of the skin and its cleanliness are very important in prophylaxis of skin diseases. Accumulation of fatty secretion, desquamated cells of the horny layer, perspiration, dust and dirt favour multiplication of pathogenic microbes on the skin. Hence the great importance of skin cleanliness for prevention of diseases. Persons exposed to oils, petroleum, tars, kerosine, petrol and like substances, should take special care to keep their skin clean. Aggressive substances on the skin should be neutralized and minor injuries properly treated. Open parts of the skin and the skin folds are easily contaminated in particular.

Various pastes and ointments (Selissky, Kochergin ointment, etc.) should be used to protect skin. Minor injuries should be treated with 1-2% alcohol solutions of brilliant green, iodine tincture, and antibiotic ointments. Medical personnel should supervise the work of showers, wash basins and other facilities in industry so that the workers exposed to contaminants could take proper care of their skin and minor injuries.

Sun baths, fresh air, and sponge baths strengthen the body and produce a favourable effect on the skin.

Neutral soaps containing no alkali should preferably be used for washing healthy skin. Children and persons with dry skin are recommended to use fat soaps (lanolin, glycerol, coal-tar soaps). If skin dryness is pronounced, the use of any soap should preferably be avoided.

On admission to the hospital, the patient should be examined thoroughly by the nurse. If lice or nits are found, the hair should be cut short or shaved, if necessary. The haired parts of the body should be washed with special soap.

If the condition of the patient is satisfactory and diffuse pyodermitis or mycosis is absent, the patient should have a shower. Patients in grave condition should be given a bath. Debilitated patients should be sunk into the bath tub on a bed sheet (and removed from it in a similar way). The bath should be given under the supervision of a nurse. She may sometimes take part in this procedure. If shower or bath is contraindicated (for pyodermitis, mycosis, pityriasis rosea, etc.), intact portions of the skin should be treated

with camphor alcohol (tampon) or warm water (towel). The washed skin should then be wiped dry. The medical personnel should supervise correct adherence of the patients to the hygienic rules and strictly follow them themselves.

### *Review Questions*

8 Patients with pyodermitis or mycosis may take a bath yes or no?

## Symptoms of Skin and Venereal Diseases

Skin and venereal diseases are the affections of the whole organism. They are manifested not only by changes in the skin or mucosa, but also by various general symptoms (signs).

Objective and subjective signs are differentiated.

The *subjective signs* are itching, pain, chill, burn, numbness and strain.

The *objective signs* are change in colour and elasticity of the skin, eruptions, etc. Eruptions may or may not be associated with inflammation. Most skin and venereal diseases are characterized by inflammatory eruptions. Skin tumours, pigmentation, atrophy, hyperkeratosis, and other skin affections are noninflammatory changes.

Skin eruptions are characterized by primary and secondary morphological changes known as lesions. The former develop on an apparently intact and healthy skin as the first immediate response to the exogenic or endogenic stimulus. Secondary lesions are formed in the evolution of the primary ones.

The division of the morphological changes into primary and secondary lesions is only conventional since all are the manifestations of one pathological process in the skin.

### Primary Lesions

These are subdivided into infiltrative and exudative lesions. The former comprise maculae (spots), papules, tubercles and nodules. Exudative lesions are vesicles, bullae, pustules, and wheals.

A spot (macula) is a circumscribed area with a changed colour. As a rule the macula is level with the surrounding tissues and does not differ from it in consistency. Pigmented and vascular maculae are distinguished. The latter may be associated with inflammation. An inflammatory vascular spot is a local reddening of the skin of variable size caused by the endogenic or exogenous stimuli. The colour of these spots is pinkish-red which later turns to blue or brown. A small (about the size of a dime) rose coloured rash is called *roseola*. This would usually be associated with syphilis, measles, scarlet fever, typhoid fever, etc. Larger spots are called *erythema* (in dermatitis, after excess exposure to sun light, etc.)

*Noninflammatory vascular spots* are formed by persistent dilation of superficial skin vessels. These are subdivided into acquired (telangiectasis) and congenital (vascular nevus).

The vessels may bleed to form *haemorrhagic maculae* due to decomposition of haemoglobin they change their colour from red to cyanotic and greenish-yellow. They do not disappear after pressing.

*Pigmented spots* develop on circumscribed sites of the skin when the quantity of pigment increases or decreases. These spots may be either congenital (nevus, or birth mark, containing increased amounts of the pigment) or acquired (freckles, chloasma, containing increased amounts of the pigment, and vitiligo or leucoderma, due to loss of melanin).

*Papule* is a small infiltration (without internal cavity) elevated above the surrounding skin, which disappears without leaving any trace except transient pigmentation in some cases. The papule may develop in the epidermis or the corium (Fig. 2) but usually the process occurs simultaneously in both the epidermis and the corium to give dermoepidermal papules (Fig. 3). Inflammatory infiltrate, hyperaemia and oedema give *inflammatory papules* (in syphilis, psoriasis, eczema). Warts and other *noninflammatory papules* are formed by thickening of the skin in any of its layers. The size of the nodule varies from a pin head (miliary) and a pea (lenticular) to the size of a big coin (nummular). Several nodules may fuse into a *patch*.

A *tubercle* is an infiltrative elevation of the skin (without internal cavity) extending to deeper layers than the papule.

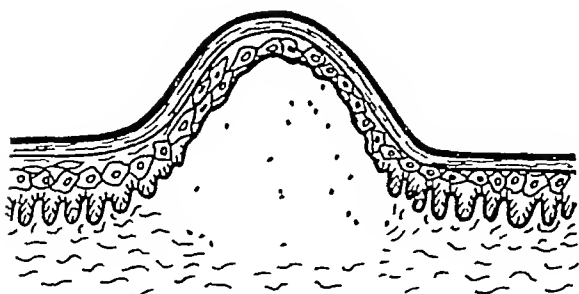


Fig 2 Dermal papule

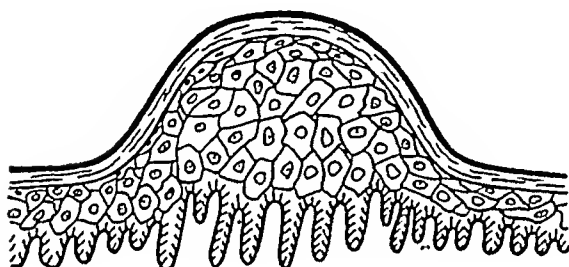


Fig 3 Dermoepidermal papule

(Fig 4) It is always necrotized to leave secondary changes on the skin such as scars or cicatricial atrophy of the skin. A nodule may be both inflammatory and noninflammatory. The former is a large infiltration (from the size of a bean to that of a hen egg) originating in the subcutaneous connective tissue. It may be affected by necrosis to turn into an ulcer leaving a scar on healing (syphilitic gumma, tuberculous scrofuloderma) or may resolve gradually without leaving any trace (leproma).

Noninflammatory nodules are lipoma, fibroma, skin new-growths, etc.

Vesicles are exudative lesions varying in size from a pin head to a pea, slightly elevated over the skin level and filled with a clear fluid (Fig 5). As they develop, their cover ruptures to form an erosion or to dry into a crust.



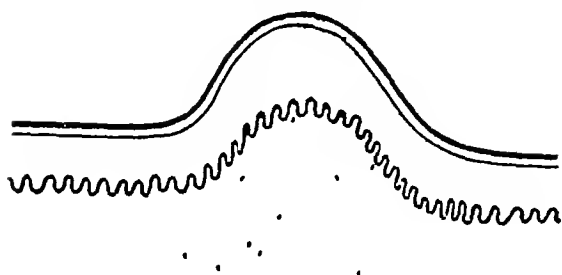


Fig 4 Tubercle

A bulla is a large (from the size of a nut to that of an egg and over) accumulation of clear exudate. Like a vesicle it heals without forming scars.

A pustule is a cavity filled with pus. Pustules may be superficial (*impetigo*), developing in the epidermis (Fig 6) and leaving no scar on healing, or deep, involving the corium (*ecthyma*) and leaving spots of pigmented cicatrization.

A wheal is an exudative formation (without cavity) elevated over the skin level. It is formed by oedema of the papillary

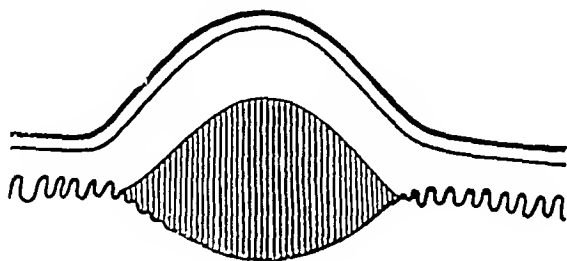


Fig 5 Vesicle

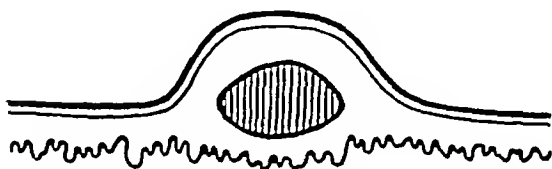


Fig 6 Superficial pustule

layer spreading over a circumscribed area. Its size varies from that of a pea to that of a palm. The colour is red, pink, or white. Its rapid development is attended with itching. A wheal is usually evanescent and disappears without leaving any traces in a few minutes or hours.

## Secondary Lesions

The primary morphological lesions develop into secondary ones: pigmentation, scales, crusts, fissures, excoriations, erosions, ulcers, scars, atrophy, lichenization, and vegetations.

Pigmentation develops due to intensified deposition of the pigment following the resolution of the primary lesions (nodules, tubercles, vesicles and pustules), and of the secondary (erosion, ulcer) lesions. The secondary pigmented spots reproduce the shape and the size of the lesions to which they succeed.

Scales are horny epithelial plates. Excessive shedding of the horny cells is known as desquamation. Scales may resemble bran or dandruff (*furfuraceous*) or they have the form of larger *plate-like* structures.

Crust is a dried bodily exudate. Crust is formed when vesicles, bullae, pustules, exudate from erosions, ulcers, etc., are dried. Depending on the character of the exudate, crusts may be serous, purulent, seropurulent, or sanguinolent.

Excoriation is a superficial damage of the skin epidermis (as produced by scratching, etc.). Excoriation is usually linear.

Cracks (fissures) usually result from overdistension of the skin or due to the loss of its elasticity (inflammation or excess dryness). Cracks may be superficial (in the confines of the epidermis) or involve deeper structures (corium).

Erosion is a superficial (epidermic) defect of the skin without involvement of the basal layer of the epidermis (Fig 7, a). It results from ruptured vesicles, bullae, or pustules. Erosion leaves no cicatrices on healing.

An ulcer is a deeper defect of the skin involving both the epidermis and the corium; deeper layers may be affected too (Fig 7, b). Ulcers develop from tubercles, nodules, and

from ruptured deep pustules. On healing, the ulcer always leaves a cicatrix.

**Cicatrix (scar)** is a coarse fibrous connective tissue which is formed on healing of a wound (an ulcer, nodule, or a tubercle).

**Cicatricial atrophy** of the skin results from gradual necrosis of the infiltrate (on sites affected by tubercles, nodules).

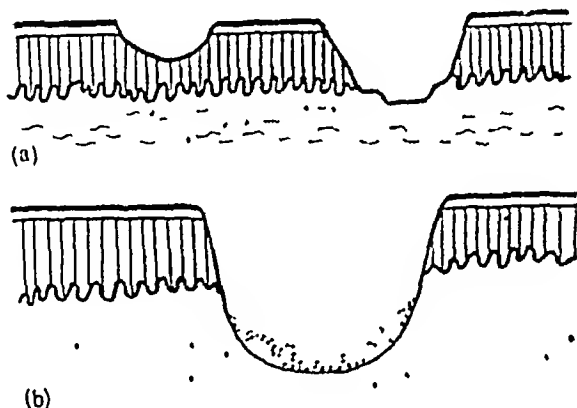


Fig 7 Erosion (a) and ulcer (b)

without ulceration and from replacement of the infiltrate by connective tissue.

**Lichenization** is the affection of the skin associated with its thickening, dryness, and intensification of the skin groove pattern. Lichenization results from infiltration of all layers of the skin.

**Vegetations** are plant-like growths on the bottom of ulcers, papules, or erosions.

Eruptions of the skin in venereal and skin diseases may be *monomorphous*, i.e. consisting of morphological lesions of one type (nodules in syphilis and psoriasis, roseola in syphilis, and warts) or *polymorphous*, i.e. consisting of lesions of several types. Some diseases are characterized by monomorphism, when primary lesions of only one type develop throughout the entire disease (psoriasis, nettle rash, furuncle, hydradenitis, etc.), while others are polymorphic, i.e. characterized by the development of primary lesions of two or more types (eczema, secondary syphilis, lepra, etc.).

*Review Questions*

9 What primary lesions are characterized by infiltration (1) vesicle, (2) papule, (3) tubercle, (4) pustule, (5) nodule, (6) spot?

10 What primary lesions develop in the epidermis (1) papule, (2) tubercle, (3) vesicle, (4) wheal?

11 What primary lesions develop in the corium (1) papule, (2) tubercle, (3) nodule, (4) vesicle, (5) vascular spot?

12 What primary lesions may leave cicatrices on the skin (1) nodule, (2) vesicle, (3) tubercle, (4) ulcer, (5) node?

13 Name primary lesions without internal cavity (1), (2), (3), (4)

14 Name exudative primary lesions (1), (2), (3)

DIAGNOSTICATION OF SKIN  
AND VENEREAL DISEASES  
BASIC PRINCIPLES

A diagnosis is established by questioning the patient (anamnesis) and by a clinical study of his general status, the nervous system, the internal organs and the bodily systems, inspection of the skin, visible mucosa, and by general and special laboratory tests

In taking history special attention should be paid to the diseases of the past, psychic traumas, living conditions, nutrition, occupational, climatic, and all other factors that might predispose the patient to the disease. Anamnestic data of patients with syphilis and gonorrhoea should be considered critically.

When examining the nervous system and the internal organs of the patient, his subjective complaints should be analysed, and objective signs of the disease revealed (these problems are discussed in detail in special courses for medical nurses).

In general examination of the skin, special attention should be paid to its colour, turgor, elasticity, function of the sebaceous and sweat glands, dermatographism, the status of the hypodermis, and the visible mucosa. The skin and the mucosa should be examined with adequate (preferably natural) illumination.

The eruption, for which the patient consults the doctor, should be examined next. Localization of the eruption is established and its character estimated: circumscribed (on separate parts of the skin), diffuse (on the major portion of the skin), or universal (covering the entire skin). Symmetrical eruptions are found on both sides of the body, while asymmetrical on one side only.

The character of eruption is established: inflammatory or noninflammatory. The inflammatory eruption may be acute (scarlet) and may be not.

It is very important to determine the primary and secondary lesions, to identify their colour, size, shape, consistency, and the character of surface. The arrangement of the lesions should be described: in groups or scattered over the entire skin, peripheral growth should also be estimated, if any (determined by repeated examination). Monomorphic or polymorphic character of eruptions should be determined. In cases with true polymorphism, eruptions consist of two or several primary lesions (e.g. spots, nodules, and vesicles). False polymorphism is characterized by the presence of several secondary lesions (e.g. ulcer, crust, cicatrix).

Correct estimation of the morphological lesions is often helpful for establishing a correct diagnosis.

Palpation, scraping of the morphological lesions, diascopy (pressing by an object glass, e.g. on a tubercle, in suspicion for haemorrhagic spot) and skin tests should also be used.

Basic laboratory tests comprise the analysis of the blood, urine, faeces, gastric juice, etc., moreover, there are special tests for *Treponema pallidum* (in syphilis), gonococci (in gonorrhoea), *Mycobacterium leprae* (in leprosy), fungi (in dermatomycoses), yeast (in candidiasis), serological tests of the blood, examination of the liquor, histological, and other tests.

## Chapter 1

# Skin Diseases

### CAUSES OF SKIN DISEASES

Skin diseases are as a rule caused by various disorders in the function of the central nervous system, internal organs, and the endocrine glands. The diseases of the skin can, in turn, have their effect on the vital bodily functions, e.g. on the central nervous system (in itching, and the like), and the internal organs. Skin diseases are therefore regarded as the general affection of the entire body.

Exogenic and endogenic causes of skin diseases are distinguished.

### Exogenic Causes

The exogenic causes of skin diseases are

(1) mechanical effects (friction, pressure) that may cause abrasion, excoriation, through which infection may enter the skin (pyodermitis, epidermophytosis, candidiasis of major folds, etc.),

(2) physical environmental factors, such as high and low temperature (burns, frost bites, chills), radiant energy, such as solar radiation, X-rays, radioactive radiation (dermatitides, eczema, malignant tumours),

(3) chemical factors, many chemicals may have direct harmful effect on the skin (strong acids, alkalis, organic solvents, petrochemical products, etc.) or they may sensitize the body (chemical allergens that increase body sensitivity on repeated exposure), such as turpentine, mercury, nickel, and others. Allergic response does not develop in all people. Sometimes skin diseases (dermatitides) are evoked by medicinal preparations on their ingestion or external application,

(4) pathogenic microbes (streptococci, staphylococci, etc) that induce pyodermatitis, tuberculosis of the skin, leprosy, etc ,

(5) pathogenic fungi (pests) causing mycoses (trichophytosis, microsporia, favus, etc ),

(6) animal parasites that penetrate the skin and live in it (itch mite, etc ), or bite the skin to cause itching (lice, bed bugs, mosquitoes, fleas, mites), hence scratching and pyoderma,

(7) filterable viruses (herpes zoster, herpes simplex, warts), contagious molluscum, etc

One causative agent may induce a disease in one man and may not in the other This depends largely on the status of the body, its nervous system, internal organs, living conditions, nutrition (abuse of alcoholic drinks decreases the body resistance)

### Endogenic Causes

The endogenous causes of skin diseases are the following

(1) dysfunction of the central nervous system In cases with eczema, neurodermitis, psoriasis, itching and some other diseases, the disordered nervous system may be either the cause or the effect of the disease, which aggravates its course

Experiments carried out by the great Russian physiologist I P Pavlov and his disciples have shown that dogs with artificially induced neurosis developed also various skin diseases When the neurotic phenomena were treated, the skin diseases subsided as well

Psychic traumas and nervous overstrain are very important for the development of skin diseases in man,

(2) metabolic disorders Patients with diabetes mellitus (disordered carbohydrate metabolism) often develop furunculosis and thrush,

(3) endocrine disorders Development of seborrhoea and acne during sex maturation is connected with dysfunction of the pituitary and sexual glands, pregnancy may cause exacerbation of psoriasis or provoke dermatitis of pregnancy,

(4) diseases of the internal organs (liver, stomach, intestine, etc ) These may provoke eczema, neurodermitis, or

nettle rash Haemopoietic diseases may cause specific skin affections and itching Helminthiasis causes prolonged eczema in children,

(5) hypovitaminosis and avitaminosis Deficiency of vitamin C provokes the onset of scurvy attended by specific skin affections, deficiency of vitamin PP is responsible for the development of pellagra, the cornification process becomes upset by vitamin A deficiency

Many skin diseases are *allergic* in their character

*Allergy* is a hypersensitive state of the body acquired to one or several particular substances These may be egg white, strawberries, some citrus plants, various chemicals, such as nickel salts, synthetic resins, medicinal preparations, e g penicillin and its derivatives, streptomycin, sulpha drugs, etc

Some diseases of the skin may be provoked by both endogenous and exogenous factors simultaneously

### *Review Questions*

15 Name the exogenous causes of skin diseases (1), (2), (3), (4), (5), (6), (7)

16 Name the endogenous causes of skin diseases (1), (2), (3), (4), (5)

## BASIC PRINCIPLES OF TREATING PATIENTS WITH SKIN DISEASES

As has already been said, diseases of the skin are closely connected with the state of the entire body Therefore, treatment of diseases of the central nervous system, internal organs, endocrine glands, helminthiasis, and elimination of foci of infection are very important for a successful treatment of patients with skin diseases

If aetiology of the disease is known, the cause of the disease should first of all be removed (e g eradication of scabies by killing the mites)

Patients with skin diseases should be given a complex course of therapy comprising the *appropriate regimen*, and *general and external medical treatment*



## General Treatment

The object of general treatment is to act on the whole body of the patient

Venipuncture (puncture of a vein) should be used for intravenous administration of medicinal preparations. Venipuncture is also indicated in the therapy of patients with skin and venereal diseases for taking blood in autohaemotransfusion, for serological tests for syphilis, for some biochemical tests, etc. Superficial ulnar veins (less frequently, smaller veins of the forearm and the hand) are usually used for the purpose. The procedure is as follows: the patient sits or lies, his arm rests quietly on the table or the bed in the extended state, for which purpose an oil-cloth cushion should be placed under the elbow. A full vein is easier to puncture. The blood outflow from the vein should therefore be held back by a tourniquet applied onto the shoulder above the elbow. The compression should not be very strong as not to stop the arterial blood flow (the pressure of the tourniquet should be relaxed if the pulse is weak or absent). If the veins do not engorge and the skin does not become cyanotic, the pressure on the arm should be increased. To ensure the required strain in the veins, the patient is asked to clench his fist several times, or to allow his arm hang freely for a while before placing the tourniquet.

The skin of the elbow flexure should be disinfected with alcohol. Using the fingers of the left hand, the veins may be examined during the disinfection. The vein which is less movable than the others should thus be found. The skin should then be stretched by pulling it downward in order to fix the vein under the skin.

Venipuncture is performed in two steps. The needle is held in the right (apt) hand with the cut plane of the needle orifice upwards and parallel to the chosen vein. The skin is then punctured at an acute angle (the needle should pass under the skin parallel to the vein and by its side). The vein is then punctured on its side (the needle enters a hollow space). Emerging blood indicates that the needle is in the vein. Otherwise, without removing the needle from under the skin, another attempt should be made. When blood emerges from the cannula, the needle should be pushed gently

forward a few millimetres, and held in the hand so that the vein should not be displaced

If a nurse is experienced, the venipuncture may be performed in one step by puncturing the skin and the vein simultaneously

The jet of blood is directed into the test tube. When the blood sample has been taken, the tourniquet is released and the needle withdrawn by a quick movement. The point of puncture should be treated with alcohol (iodine tincture should not be used in patients with skin diseases to preclude possible irritation). A sterile cotton wool pad should be pressed against the punctured spot, or a dry sterile pressing bandage applied.

For the purpose of autohaemotherapy the blood is taken into a sterile syringe.

Intravenous jet infusions are normally performed in patients with skin and venereal diseases, but in grave cases with acute erythematosus, pemphigus, erythroderma, systemic candidiasis and some other dermatoses, drip infusion is used. Jet infusion is performed by a syringe, while a system of tubes and a dropper are used for drip infusion.

Before puncturing a vein for intravenous infusion, it is necessary to check the syringe for the absence of air bubbles, for which purpose the syringe is held in the vertical position and the air is expelled from it followed by a jet of a small portion of the liquid. If many small bubbles are seen in the solution, the piston should be slightly moved back and the syringe contents shaken slightly several times, when smaller air bubbles fuse into a large bubble, the latter should be expressed from the syringe by the onward movement of the piston.

Before making an injection the nurse should remove carefully the tourniquet. The needle may disengage from the vein and before infusion of the solution the nurse should make sure that the needle is in the vein by pulling back the piston. Entrance of the blood into the syringe indicates that the needle is in the vein. The medicinal solution may now be infused. To preclude the entrance of even small portions of the medicine under the skin when the needle is removed from the vein, the piston should be pulled back slightly to suck in the medicine from the needle into the barrel of the sy-

ringe The onward movement to the piston during injection of the medicine may be ensured by the pressure of the thumb of the left hand, but the syringe may also be held in the left hand, while the index and the middle fingers of the right hand should rest against the bead of the barrel with the thumb of the right hand pressing on the piston Handling the syringe from one hand over to another should be done with special care as not to allow the needle escape from the vein If, however, this happens, a quickly growing tumour will indicate quite vividly the error and the patient will complain of the burning feeling Without removing the needle the nurse should make an attempt to suck in the solution from under the skin, disjoin the syringe from the needle, fill quickly another syringe with an isotonic solution of sodium chloride, connect it to the needle and inject a few millilitres of the solution so that the concentration of the medicine might be lowered and possible necrosis of the tissues precluded Drip infusion of solutions is done in rare cases with dermatological diseases The procedure is the same as in drip infusion in surgical and therapeutic practice

Intracutaneous injections are used in Mantoux tests for tuberculosis, in allergic tests (for example, to reveal occupational dermatosis), for administration of hydrocortisone (for treatment of alopecia), etc From 0.01 to 1 ml of liquid should be injected intracutaneously The thinnest and the shortest needles should be used for the purpose The nozzle of the needle should have an angle of  $40-45^\circ$ , and the capacity of the barrel should be one millilitre The liquid meets high resistance of a thin needle during injection and the piston should therefore be well lapped to the barrel Diagnostic allergic tests and determination of sensitivity to medicinal preparations should be done on the median surface of the forearm The skin should be treated with alcohol and dried The needle should be held with its cut surface upwards The needle point is pierced at an acute angle, so that the needle is almost parallel to the skin The skin should be punctured to a small depth, only to allow the nozzle enter the skin The liquid is then expressed from the barrel The blister will resolve in 30-60 minutes Subcutaneous injections are mainly done into the lateral

surface of the shoulder and the thigh, less frequently into the subscapular (vaccinations) and abdominal regions. The syringe should be held vertically before the injection and the air expelled from the barrel. The skin at the site of the injection should be wiped with alcohol. A thin needle should be used for aqueous solutions and a thicker one for oil injections. The skin is grasped by the left hand to make a fold and the needle is plunged by a quick motion into the base of the skin fold to two thirds of its full length. The skin should be punctured from below at an angle of  $30^\circ$  to the surface of the shoulder. After the solution has been

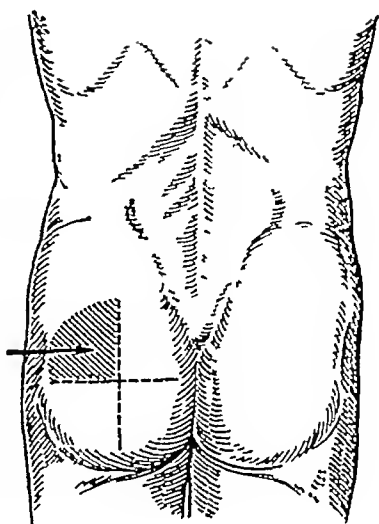


Fig 8 Outer upper quadrant for intramuscular injections

expressed from the syringe, a cotton wool pad soaked in alcohol is pressed against the punctured site, and the needle is then pulled out quickly. The site of injection should be rubbed gently using the pad. An alcoholic solution of iodine is then used to treat the punctured skin.

Intramuscular injections are used in dermatovenereology for administration of medicines for their gradual absorption, such as bicillin, ecmonovocillin, biochinol, bismoverol, etc.

A long (5-6 cm) needles with sufficiently wide lumen should be used for intramuscular injections. The injection should be done into the upper lateral part of the buttocks (Fig 8).

Injections may be performed in one and two steps. If water-soluble preparations, such as penicillin, should be administered, the injection is performed by a single step, with a syringe held over the injection site in the perpendicular position with respect to the skin. By a swift movement the skin and the subcutaneous cellular tissue are first punctured and the needle is then further advanced into the muscle. (Before puncturing the skin, it should be pressed slightly by the fingers of the left hand.) If the needle penetrates too far

to reach the bone, it should be pulled back slightly. The contents of the barrel may now be expressed into the muscle.

If the preparation is administered by a two-step method, the needle alone is first used to puncture the skin to reach the required depth. If blood emerges from the cannula, the needle should be extracted and a new needle used to puncture the skin in another point of the same region. If blood does not appear from the cannula in the lapse of 30-40 seconds, the syringe containing the solution should carefully be attached to a firmly held needle and the medicinal preparation then expressed slowly from the syringe.

In faulty injections (e.g. performed with short needles, in obese patients in particular) subcutaneous infiltration may develop which may be attended with inflammation and painful sensations. This will be likely to happen in injections of bismoverol or buochinol, if these preparations get into the subcutaneous connective tissue. Infiltration should be treated by warmth (application of paraffin, ichthammol, diathermia, etc.). In order to preclude infiltration, the patient should be recommended to walk and perform other active movements, a hot water bag should be applied in cases of incipient filtration.

A deep gangrene (eschar) is a rare but dangerous complication at the site of injection. It develops due to occlusion (embolism) of an artery by suspension of the medicinal preparation in oil. The skin of the buttocks soon becomes oedematous, bright red, with radiant branches extending from the centre toward the periphery, sharp shooting pains develop. Necrotized portions become vivid in 5-7 days with subsequent development of deep necrotic ulcers. This complication should be treated as gangrene (by methods used in surgery).

The general treatment comprises the following:

1. Action on the central nervous system by psychotherapy, hypnosis, sleep, and preparations of bromine, valerian, procaine, andaxin (mecprotan), chlordinazepoxide (elenium), trioxazin, aminazin, and nanophyn.

Psychotherapy (suggestion, persuasion, etc.) may produce a favourable effect on the psyche of the patient, improve his subjective condition and body resistance.

Hypnosis and sleep give rest to the cells of the brain and provide for protective inhibition

Sodium bromide (less frequently bromides of potassium or ammonium) are given per os as a 0.25-3 per cent solution (one tablespoonful three times a day) or as intravenous infusions of a 10 per cent sodium bromide solution, 5-10 ml daily, for a total of 8-10 infusions for the course. Bromine preparations should not be given for lengthy periods (in eczema, neurodermitis, psoriasis, nettle rash, itching) since signs of bromism (skin eruption) may develop.

Procaine should be given as a 0.5 per cent solution, one tablespoonful 2 or 3 times a day (an hour before meals) for 1-1.5 month, or intravenously, 2-6-10 ml of a 0.25-0.5% solution (a total of 8-10 infusions). Possible side effects of intravenous infusions of procaine are vertigo and headaches, the patients are recommended to stay in bed for a while after infusion.

Infusion of valerian root (*Infusum rad. Valerianae*) should be given 3-4 times a day as a solution of 6-10 g in 200 ml of water, one tablespoonful for one intake. Tincture of valerian root (*Tinctura rad. Valerianae*) should be given as a 20% solution in 70° alcohol, 20-30 drops three or four times a day.

Meprostan (antaxin), trioxazin and chlordiazepoxide (elenum) should be given for a month (one tablet, 2-3 times a day).

Aminazin should be given per os, 0.025-0.05-0.1 g 2-3 times a day, or intramuscularly, 1 ml of a 0.25% solution before night sleep. Nanophyn is given in 0.1 g tablets, 2-3 times a day or 1 ml of a 2.5% solution subcutaneously before night sleep for 2-3 weeks.

Procaine, bromine preparations, aminazin may cause toxicoderma or exacerbation of allergic dermatitis. Tolerance of these preparations should therefore be first established (by questioning or by examining past history cases).

2. Desensitizing treatment is given to patients with allergic diseases to decrease their increased sensitivity to various stimuli. Corticosteroids (see below), vitamins C and P (see below), calcium chloride, sodium hyposulphite, calcium gluconate are desensitizing anti-inflammatory preparations. Calcium chloride should be given after meals, one table-

spoonful of a 10% solution, 3-4 times a day, or injected intravenously as a 10% solution (5-10 ml, 7-10 infusions, slow administration) The patient should obligatory be warned that during infusion he might feel fever, which persists for a time after cessation of the infusion Sodium hyposulphite is prescribed intravenously as a 10-30% solution (10 ml daily or every other day), and sodium gluconate is given per os, 0.5 g three times a day or intramuscularly, 10 ml of a 10% solution, depending on gravity of the process

*Antihistaminic (anti-itching) preparations* belong to the same group of medicines suprasin in 0.025 g tablets, diprazine (pipolphen) in 0.025-0.05 g tablets, diazoline (0.1-0.2 g), dimedrol (0.03-0.05 g), ethyzine (0.025 g), alfadryl (0.025 g), pernovin (0.025 g), tablets These preparations are given 2-3 times a day Dimedrol may be given intramuscularly as a 1% solution (1-5 ml)

**3. Immunotherapy** strengthens immunity of the patient This may be *specific* therapy staphylococcal vaccine (1 milliard killed microorganisms in 1 ml, from 0.2 to 1 ml two times a week, 8-12 subcutaneous or intramuscular injections), staphylococcus toxoid (from 0.3 to 1.5 ml, 2-3 times a week, intramuscular or subcutaneous injections into the interscapular region, a total of 7-8 injections), staphylococcal antiphagin (from 0.2 to 1 ml daily, a total of 8-10 subcutaneous injections), and *nonspecific* therapy injections of autoblood (2-5-10 ml, 6-8-10 injections at a 3-4 day interval, the vein is punctured in sterile conditions, the wanted amount of blood is taken and reinjected immediately into the upper outer quadrant of the buttocks), milk injections (intramuscularly two times a week, a dose increasing from 2 to 10 ml, 4-6-8 injections), donor blood transfusion (50-70-100-200 ml, 1-3 transfusions at a 2-4 day interval), autoserotherapy (25-30 ml of blood is taken from the patient with a fasting stomach, the blood in a test tube is placed in a thermostat and kept at 37°C for 15-20 minutes, the test tube is then placed in a refrigerator for 24 hours, the separated serum is taken into a syringe and injected intravenously, 1-2 times a week for a total of 5-6 injections in a course), pyrogenal or prodigiosan injections (the former in 25-50-80-100-150 MPD, etc., to 1000 MPD, the latter 10-20-50 µg, etc., 5-8 injections) Given for the same purpose may be the following pentoxyl

(0.15-0.25 g in tablets), methyluracil (0.5 g) one tablet 2-3 times a day to adults, and gamma globulin (0.5 ml per kg body weight intramuscularly, once in 3-4 days for a course of 5-8 injections, or 0.1-0.15-0.2-0.25-0.3-0.5 ml intracutaneously at a 3-5 day interval, for a course of 10 injections), histaglobulin (histamine-globulin complex) from 0.1 to 1 ml subcutaneously, two times a week, ten injections for the course, the preparation should be prepared *ex tempore* or taken from ampoules

4. Vitamin therapy Vitamins are widely used to treat patients with skin diseases

Vitamin A is given to patients with disordered process of cornification, skin dryness, etc., the vitamin is given as a concentrated solution, 10-30 drops three times a day before meals (on rye bread), dispersed vitamin A is also used 2-3 ml 2-3 times a day for a total of 30-40 days

Vitamin C (ascorbic acid) is given in affections of the vessels and in allergic diseases. Ascorbic acid is given per os, 0.1-0.2 g three times a day, as intravenous injections (5-10 ml of 5% solution), or intramuscular injections (2-5 ml of 5% solution). Vitamin C should preferably be given together with rutin (0.04-0.05 g for an intake) or ascorutin (vitamins C and P)

Vitamin B complex produces an antihistaminic and anti-allergic effect. This is a group of vitamins, viz. vitamin B<sub>1</sub> (thiamine), B<sub>2</sub> (riboflavin), B<sub>3</sub> (pantothenic acid), B<sub>6</sub> (pyridoxine), vitamin H (biotin), B<sub>12</sub> (cyanocobalamin), B<sub>13</sub> (orotic acid), B<sub>15</sub> (pangamic acid)

More frequently used are vitamin B<sub>1</sub> as a 5-8% solution, 1 ml intramuscularly, or 0.02-0.08 g per os three times a day, vitamin B<sub>2</sub>, 5-10 ml per os three times a day, vitamin B<sub>6</sub>, 1 ml intramuscularly (5% solution), vitamin B<sub>12</sub>, 30-100 µg and over intramuscularly. Calcium pantothenate is often given to children with eczema, neurodermitis and psoriasis, the preparation is given in a dose of 0.05-0.1 g to children under three years of age and 0.1-0.2 g to those over 3 to 14

Vitamin E (tocopherol) activates vitamin A. It is indicated in cases with scleroderma, psoriasis and neurodermatitis. The new Soviet-made preparation aevit (1 ml contains 100 000 I.U. of vitamin A and 100 mg of vitamin E) is given intramuscularly (1 ml), daily or every other day



Nicotinic acid (vitamin PP) is given intramuscularly or intravenously as a 1% solution (2-10 ml), or per os (in 20-30 minutes after meals) in 0.05-0.1 g doses three times a day. (Nicotinic acid may cause transient reddening of the skin and a fever)

5 Antibiotics The group of antibiotic preparations is rather great, but the most important antibiotic used for treatment of patients with skin diseases remains *penicillin*. As a rule it is administered intramuscularly, 100 000-200 000 units in 2-3 ml of 0.25-0.5-1% procaine solution 4-5 times a day, or as ecmonovocillin in a dose of 600 000 units once a day. The latter preparation is injected in two steps\*. Patients with tuberculosis of the skin are given streptomycin (500 000 units twice a day) or dihydrostreptomycin. One gram of dry vial powder contains 100 000 units of streptomycin or dihydrostreptomycin. The content of the vial is dissolved in 4-5 ml of 0.25% procaine solution or sterile isotonic sodium chloride solution. Levomycetin is given in a dose of 0.5 g 3-4 times a day, chlortetracycline hydrochloride (biomycin), tetracycline, oxytetracycline dihydrate, metacycline (ron-domycin), tetraclean, and oletetrin should be given in 0.25 g doses 4-5 times a day. Erythromycin is given in a dose of 200 000 units at a 4-6 hour interval for 5-12 days. Oxytetracycline, monomycin and neomycin sulphate (mycerin) are given intramuscularly or in tablets. Monomycin is given in a dose of 0.25 g (250 000 units) three times a day to adults and 0.004-0.005 g (4 000-5 000 units) per kg body weight to children three times a day at an 8 hour interval for a total maximum of 5-7 days.

Antibiotics can cause side effects and complications such as itching, toxicoderma, yeast affections, etc. Antibiotics should therefore be given with care.

6 Corticosteroids Corticosteroids are most effective anti-allergic and anti-inflammatory preparations (prednisolone, triamcinolone, dexamethasone, etc.) Children tolerate injections of adrenocorticotrophic hormone (ACTH) in a dose of 5-10-15-20 units daily (depending on age) better than adults. A total dose for a course of treatment is 50-300 units.

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\* The dose of penicillin depends on the character and gravity of the disease,

In grave diseases of the skin which endanger the life of the patient (pemphigus, acute lupus erythematosus, etc.), big doses of corticosteroids are first given and then gradually decreased. In diffuse forms of eczema, neurodermitis, psoriasis with persistent course, moderate doses of corticosteroid hormones (20-40 mg of prednisone or prednisolone daily, 16-20 mg of triamcinolone, 3-4 mg of dexamethasone) are sometimes prescribed.

Big doses of steroids are given to patients in hospitals under supervision of a doctor because dangerous complications may develop. A sudden suspension of steroid therapy may exacerbate dermatosis or provoke the withdrawal syndrome (restlessness, asthenia, vertigo, pains in muscles and joints, etc.).

Patients treated with corticosteroids should have their arterial pressure, prothrombin index, sugar of blood and urine regularly measured (once in ten days).

Most frequent complications are increased arterial pressure, tachycardia, excitation, deranged sleep, abdominal pains that simulate sometimes 'acute abdomen', increased sugar content of blood and urine (steroid diabetes), thrombophlebitis, candidiasis, exacerbation or development of pneumonia and furunculosis.

Complications are possible in patients treated with ACTH serum disease, nettle rash, and Quincke's disease.

*Anabolic hormones* are indicated: nerobol or phenobolin (5 mg, in tablets), methylandrostenediol (0.025 g, in tablets).

Phenobolin (durabolin) and deca-durabolin are given intramuscularly once in 5-7 days (1 ml contains 25 mg of the preparation). Retabolil can also be given (1 ml contains 50 mg of the preparation).

7. **Sulpha drugs** These are norsulphazole, sulphadimezine, ethazole and others. They are given per os in doses 0.5-1 g for 3-4-6 times a day for 5-10 days. Sulpha drugs of prolonged action are sulphapyridazine (quinoseptyl) and sulphadimethoxine (madribon), these are used in doses from 1.5 to 2 g once a day in the course of 7-14 days.

### Review Questions

17 Name the methods of general therapy of patients with skin diseases (1), (2), (3), (4), (5), (6), (7)

18 Which of the following are antihistaminic preparations: (1) suprastin, (2) ascorbic acid, (3) thiamine, (4) dimedrol, (5) pipolphen?

### External Treatment

External treatment of patients with skin diseases is performed simultaneously with the general medicamentous therapy and the appropriate diet. The object of external treatment is to control eruptions, to decrease itching, burning, and pains. External treatment is a prerogative of a nurse.

Treatment begins with *cleaning the focus of affection* from scales, crusts, pus, remnants of vesicles, etc. To that end forceps, curved-end scissors and cotton wool pads soaked in 3% hydrogen peroxide solution are used. No effort should be applied to remove scales, crusts, or remaining ointment. Sunflower seed oil, persic or some other suitable oil should be used to wetten and soften crusts, etc. If scales, crusts, etc. do not separate in 10-15 minutes, an oil bandage should be left for a longer time. Contaminated erosions or ulcers should be treated with a 3% hydrogen peroxide solution, while the surrounding skin should be wiped with camphor or 2% salicylic alcohol.

If the patient with skin diseases cannot move about unassisted (erythroderma, grave mycosis, pemphigus, systemic lupus erythematosus, grave arthropathic psoriasis, etc.), the bed linen should be changed by the nurse and an assistant. The patient should be turned to his side, the used sheet rolled up and removed from under the patient, while a clean sheet is placed on the free part of the bed with half of its width being rolled up. The patient is moved onto the clean sheet and the rolled end is then spread over the rest of the bed. The used sheet may be rolled up from the tail and head ends too, the clean sheet is placed under the patient head and unrolled. The used sheet is removed from the tail end of the bed. Bed sheets and the underwear of these patients should always be well spread (without pleats or creases) to preclude formation of bed-sores. When changing a shirt, the used one should be pulled upwards to the armpits, then pulled over the head and finally off the arms. In especially grave cases with diffuse dermatosis (e.g. in erythroderma) shirts opening on the back should be put on patients.

Hygiene of grave dermatological patients should be maintained by the medical personnel (assistant doctor, nurse, junior nurse) Morning toilet is performed over a basin with water poured from a jar Weak solutions of potassium permanganate should be used to wash the genitals and the anal region of such patients Cotton wool should be held in forceps The eyelids are washed by cotton wool soaked in a 2% boric acid solution The mouth should be rinsed with weak solutions of furacin (0.02%, 1 : 5 000), potassium permanganate (0.01%, 1 : 10 000-0.1%, 1 : 1 000), ethacridine lactate (rivanol) (0.05%, 1 : 2 000-0.1%, 1 : 1 000) The tongue and the mouth cavity should be wiped with a 1% borax solution containing a 10% glycerol solution, using a gauze wound round a spatula and soaked in this solution

Powders, wet dressings, lotions, fomentations, application of aqueous or oil suspensions, pastes, ointments and other medicinal forms should be used for external treatment of patients with skin diseases

1. Powders Medicinal powders are applied over the affected site in a thin layer (Fig. 9) Neutral powders contain zinc oxide, talcum, starch, white clay They relieve itching, inflammation, dry up the skin (intertrigo), cool it, and take up exudate Powdered sulpha drugs (white streptocide, etc), xeroform, dermatol are used to treat erosions and ulcers

2. Lotions Cooling solutions of medicinal preparations are used to moisten 2-4 gauze napkins, which are then slightly pressed to remove excess liquid, and applied to the affected site (Fig. 10) The dressing should be changed at 5-15 min intervals (as it becomes dry), the procedure continues for half an hour and repeated 3-5 times a day (depending on the gravity of the affection) Lotions decrease weeping and oedema, lessen itching and burning sensations, i.e. act as anti-inflammatory means by narrowing the vessels A 1-2% tannic acid, 0.25-0.5% silver nitrate, 2-3% boric acid, and 0.25-0.3% amidopyrine solutions are mostly used for the purpose Lead water is also popular

Disinfecting lotions are used in cases where pyogenic infection is involved Rivanol (0.1%), furacin (1 : 5 000), potassium permanganate (0.05%), and resorcinol (1-2%) solutions are used for the purpose



Fig 9 Applying powder



Fig 10 Using lotion

3. Wet dressings are given in the same cases as lotions but 8-12 layers of gauze should be applied; this dressing dries in 30-60 minutes and should then be renewed. If the dressing does not easily separate from the affected site, it should be wetted with the same solution. This dressing should be used in local affections with marked infiltration and weeping. Pyodermitis and diffuse acute inflammatory diseases of the skin are contraindications to wet dressings.

4. Dermatological compresses are used in chronic inflammatory processes with deep limited infiltration of the skin and the subcutaneous cellular tissue (neurodermitis, etc.). Gauze folded in 10-12 layers is wetted with a medicinal solution (lead water, 2% boric acid solution, etc.), excess liquid is pressed out, and the compress applied onto the affected site. A sheet of waxed paper (of slightly larger size) is placed over the gauze. The compress is bandaged and renewed once or twice a day.

5. Alcoholic or aqueous solutions of aniline dyes (e.g. brilliant green) are used as paints, aqueous-alcoholic solutions of menthol (1-2%), carbolic acid (1-1.5%) and aqueous solutions of blue vitriol (2-10%), and silver nitrate (2-10%) are used to soothe itching in neurodermitis.

6. Aqueous and oil suspensions (shake lotions). Water, glycerol, and powdered substances (30% of total mass) make an aqueous shake lotion. Zinc oxide, talcum, white clay, and starch are most common powders used in suspensions. Aqueous suspensions are used as anti-inflammatory means to soothe itching and burning. Shake lotions may contain alcohol and water. Oil shake lotions are prepared from the same powders, except that oils (sunflower, persic, or vaselin) are used as a vehicle. A shake lotion containing 30% zinc oxide in 70% vegetable oil is often used. Oil shake lotions soften the skin, facilitate removal of scales and crusts and lessen the feeling of strain.

Aqueous and oil suspensions should be shaken before use. Using a pad of cotton wool the shake lotion is applied onto the affected site of the skin, preparations of sulphur, ichthammol, coal tar, menthol and other substances can also be added to suspensions. The suspensions are easily drying substances and need no dressing. They should not be used in strong weeping or applied to the haired parts of the head.

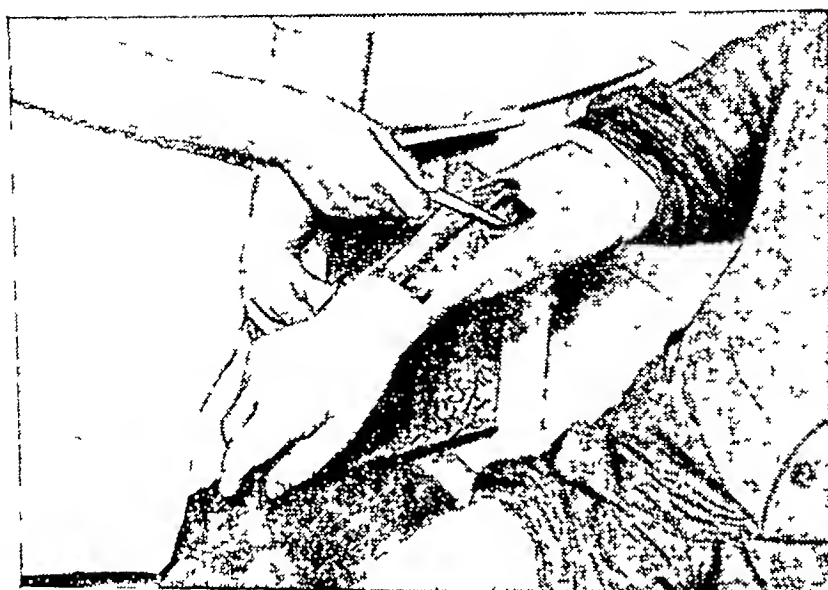


Fig 11 Applying paste

7. Pastes These are mixtures of equal parts of powdered medicines (zinc oxide, talcum, etc ) and fat (lanolin, vaseline, etc ) Their effect is deeper than that of shake lotions but they are less active than ointments Pastes have anti-inflammatory and drying effect Thick pastes stick to the skin well and need no dressing Pastes are not applied to weeping lesions on the haired part of the head They should be applied 1-2 times a day Once in three days the paste should be removed from the skin by cotton wool impregnated in vegetable oil

Zinc paste consisting of equal parts of zinc oxide, talcum, lanolin and vaseline is often used Ichthammol, naphthalan, resorcinol, preparations of sulphur, coal tar, etc , are added to the paste for special indications A spatula should be used to apply pastes to the affected skin (Fig 11) By light movements of the spatula the paste is spread over the affected site A piece of gauze is placed over the paste and a bandage (not more than 2-3 turns) is finally applied

8 Ointments contain one or several medicinal preparations mixed uniformly with a fat vehicle (vaseline, lanolin, lard,

naphthalan, etc ) Ointments are prescribed in chronic and subacute skin diseases in the presence on the skin of inflammatory infiltration, since their effect is deep Popular are 2-10% sulphur ointment, 2-3% tar ointment, 1-3% white precipitate ointment, 2% salicylic ointment, 2-5% ichthammol ointment, 2-3% naphthalan, and also antibiotic ointments (erythromycin, biomycin, etc ) Interferon ointment is used to treat herpes zoster and herpes simplex

Used also are ointments containing *corticosteroids* (sinalar, ftorokort, flucinar, prednisolone, hydrocortisone, depersolone), corticosteroids and antibiotics, such as oxycort, geocorton, locacorten (with neomycin, vioform, tar), ultralan, dermosolon, depersolon, monomycin-prednisolone (10 g of the ointment contains 1 000 000 units of the antibiotic and 0.1 g of prednisolone), and sinalar

Steroid ointments and other external preparations should not be used for a long time (over large skin areas in particular) since the absorbed hormones may have an adverse effect on the patient and give local complications (atrophy of the skin, development of telangiectases, etc )

The ointment is applied with a spatula in an even layer over a piece of linen and placed on the affected site which is then bandaged Ointment may be applied directly to the skin without any bandage The ointment should be rubbed into the skin of patients with scabies and pityriasis versicolor The affected sites are treated with paste or ointment 1-2 times a day Sometimes ichthammol or tar are used *per se* (without vehicle), the substances should then be applied once in two days Pastes and ointments are kept in glass bottles and the necessary portion is given to the patient on a piece of waxed paper (Fig 12)

The nurse should see to it that the bottles or other containers with ointments, lotions, solutions, etc , be supplied with labels giving the name of the medicines and the date of their preparation It is not allowed to use external preparations whose date of expiration has passed since they can cause irritation and inflammation of the skin (dermatitis)

9. Plaster. In addition to fat, the vehicle of plaster contains also wax or colophony Compared with ointment, plaster has a thicker and sticky consistency Before use, plaster is warmed up and applied onto the affected site in a thick layer





should finally be rinsed with hot water. Once a week the bath tub should be washed with dilute hydrochloric acid, soda solution, kerosine, or special paste. Rust patches should be removed by oxalic acid.

Medicated baths should preferably be given 30-40 minutes after a light breakfast or in 1-2 hours after dinner.

Starch and bran (wheat or almond) baths are used as emollient and soothing means (to control itching). Starch or bran (500-1 000 g) in a linen bag is immersed in tepid or lukewarm water of the bath, and the bag contents is expressed from time to time into the water. A bran decoction may be prepared beforehand by boiling 1-2 kg of bran and adding the filtered decoction to the bath. Almond bran may be added directly to the bath. Medicated baths should be taken for 30-60 minutes and over.

Bath and douche are indicated in psoriasis and neurodermatosis. Water cleanses the skin from remnants of medicinal preparations and crusts, it loosens thickened horny layer of the epidermis, has a soothing effect on the nervous system and improves blood circulation.

### *Review Questions*

19 What percentage of powdered medicines do shake lotions contain?

20 What percentage of powdered substances do pastes contain?

21 Which of the following substances may be used as vehicles for ointments (1) vaseline, (2) sulphur, (3) lard, (4) tar, (5) ichthammol, (6) naphthalan?

### **Physiotherapy**

Warmth and cold are often used in treatment of skin diseases. Heat treatment is effected with Minin light, 'Sollux' lamp, general and local baths (sun baths including), paraffin and ozokerit applications, local and segmental diathermia.

Pathological tissues may be killed by freezing with carbon dioxide snow or liquid nitrogen (cryotherapy).

Quartz mercury (Bach) lamp, Kromayer's lamp, and other lamps (giving ultra-violet radiation), sometimes X-rays

and radioactive substances are used. Electricity is used for electrolysis, galvanocautery and diathermocoagulation to destroy pathological tissue (warts, birthmarks, etc.) Local d'arsonvalization is used to treat itching diseases of the skin.

UHF currents are used to treat furunculosis and hidradenitis. Laser has recently been used in medicine to treat trophic ulcers and other diseases.

### Health-resort Therapy

Treatment at health resorts is an effective and important type of therapy of many chronic diseases of the skin. Health resorts are indicated to patients with chronic eczema, neurodermitis, psoriasis, itching, lichen ruber planus, scleroderma, nettle rash, ichthyosis, lupus tuberculosus, papulonecrotic tuberculosis, etc.

Sea bathing, mineral-water baths, naphthalan oil, and muds are useful therapeutic means used at health resorts in addition to sun and air baths.

Waters used for mineral baths are as follows (1) *sulphide waters* (containing sulphur). Hydrogen sulphide penetrates into the body through the skin (90%) and the respiratory tracts. Concentration of hydrogen sulphide varies from 25-40 to 100-150-200 mg/litre. A course comprises 10-15 baths (taken every other day). Hydrogen sulphide baths may be prepared artificially: to 200 litres of fresh water (of the required temperature) added are 825 ml of a 10% solution of sodium sulphide and 200 ml of 27.5% hydrochloric acid. The bath will thus contain 100 mg of free and 150 mg of total hydrogen sulphide. The room where the hydrogen sulphide baths are prepared should be provided with adequate ventilation since constant exposure of the personnel to hydrogen sulphide in concentration of 0.01 mg per litre of air is toxic. Usual concentration of total hydrogen sulphide in the bath is 75-100 mg/litre, baths with concentrations of 150-200 mg/litre are less frequently used. The concentration should be increased gradually from 25-50 mg/litre to higher concentrations. The temperature of water in the hydrogen sulphide bath should be 34-36°C, the duration of the pro-

cedure, 10-15 minutes. The patient should be kept away from cold after taking bath, other physiotherapeutic procedures (baths included) are contraindicated to the patient on this day, (2) *radon baths* may be slightly radioactive (from 10 to 27 Mache units), moderately radioactive (from 28 to 82 Mache units) and strongly radioactive (over 82 units). Duration of the hydrotherapy from 5 to 15 minutes, the total number of baths per course being 12-20 (taken every other day). Artificial radon is prepared according to a special instruction. A radon solution is added to the water in the bath at the wanted temperature (normally 34-36°C), (3) *silica baths*, containing small quantities of mineral salts, (4) *carbon dioxide baths*.

*Muds* (applications) have thermal, mechanical, chemical and radioactive effects and are used in chronic inflammatory diseases.

### Diet of Patients with Skin Diseases

Prescription of a particular diet to a patient depends on the character of dermatosis and the accompanying disease (or diseases), if any. If a patient, for example, with psoriasis, eczema, or any other dermatosis, suffers from metabolic disorders or a gastrointestinal disease, the appropriate diet is prescribed to him by an endocrinologist or a therapist.

Eczema, neurodermitis, nettle rash, prurigo and some other skin diseases often arise due to food allergy. Not infrequently, the cause of persistent skin diseases are eggs, milk, honey, strawberries, mushrooms, citrus fruits, fish, meat, smoked fish or meat, etc. Patients with itching dermatoses are therefore prescribed the diet free from spicy and bitter foods, alcohol and all other foods that may exacerbate the main process. Pregnant women with allergic dermatosis in past history are also given this diet. Nursing mothers with diathesis and itching dermatosis must adhere strictly to the prescribed diet.

Patients with pyodermitis and disordered carbohydrate metabolism are prescribed a diet deficient in carbohydrates. Food rich in cholesterol should be limited in the diet of psoriasis patients. Ample water and diuretics which increase excretion of toxic substances from the body are indicated in

dermatosis attended with diffuse acute inflammatory and weeping foci

The diet is especially important to patients taking steroid hormones. They should take sufficient amount of potassium, proteins, and foods rich in vitamins (vitamin C in particular)

### PYODERMITIS

Pyoderma (from Greek *pyon* pus and *derma* skin) is caused by staphylococci, streptococci and other pyogenic microbes that penetrate the skin. Pyoderma is one of the most frequently occurring skin diseases. The disease decreases the work capacity of man and can even cause transient disability. The disease occurs in both adults and children.

Neglect of hygienic rules, unfavourable labour or living conditions facilitate spreading of the disease. When pyogenic microbes get on the skin, they do not however cause the disease in all healthy persons. Their propagation depends on the status of the body and the environmental conditions. Injured skin, irritation of the skin by chemicals, mineral oils, high ambient temperature, especially in combination with high humidity, etc., favour the development of pyoderma. Disorders in the central nervous system and internal organs, hypovitaminosis, disordered metabolism (protein or carbohydrate metabolism, as in diabetes) decrease the body resistance and are endogenic factors facilitating the onset of pyoderma.

Superficial and deep pyoderma caused by staphylococci, streptococci and combinations thereof are distinguished.

*Staphylococcal* pyoderma is characterized by the affection of hair follicles and sweat glands. Pustules are cone- or hemispherically shaped formations with thick walls, they are firm and contain thick yellow-green pus, a fine hair is often found in the centre of the pustule.

Pustules of *streptococcal* pyoderma are flattened, with thin flabby walls, the exudate is seropurulent.

*Superficial* pyoderma develops in the confines of the epidermis and leaves transient pigmentation of the skin, *deep* pyoderma involves the corium and in some cases the sub-

cutaneous connective tissue, cicatrices and cicatricial atrophy always remain after deep pyoderma

Pyoderma may develop concurrently with various itching diseases of the skin (secondary pyoderma)

### Superficial Pyoderma

Commonly occurring superficial pyoderma are impetigo, sycosis, and impetigo neonatorum (impetigo of the newborn)

Impetigo. Streptococcal, staphylococcal impetigo and impetigo vulgaris are differentiated

*Streptococcal impetigo* (impetigo streptogenes) would usually develop in children This is a superficial planar non-follicular vesicle with a thin flaccid wall and serous contents The vesicle would be found on a hyperaemic base, sizing from a millet grain to a walnut The vesicle contents become turbid and seropurulent The pustule dries to form a yellow crust The process is localized on thin and tender skin, such as of the face, sides of the trunk and of the extremities The affected site is itching and the patient, especially a child, would scrape off the vesicle or pustule cover to form erosions which later become covered with yellow crusts The crusts fall off to leave pigmented spots The disease quickly spreads at kindergartens and similar children's institutions and is therefore called impetigo contagiosa

Streptococcal impetigo (*perlèche*) attacks the labial commissures of the mouth An elongated flat vesicle is formed at one or both angles of the mouth, which promptly turns into a pustule or a painful crack surrounded by serous or seropurulent crusts Because of constant irritation by the saliva, food, etc., *perlèche* may persist for months

Streptococcal impetigo attacks the skin surrounding finger-nails to cause a disease known as *superficial paronychia* or *paronychia*, the affection is rather painful

*Mixed impetigo*, or *impetigo vulgaris* is caused by mixed streptococcal and staphylococcal infection The onset of the disease is marked by slight elevation of body temperature and burning is felt at the site of future eruption Vesicles develop on hyperaemic and slightly oedematous skin, the vesicles turn into pustules which dry to thick and irregular



Fig 13 Impetigo vulgaris

honey-yellow crusts (Fig 13) Impetigo vulgaris usually attacks the face of children, young girls and women

*Staphylococcal impetigo* (impetigo staphylogenes), or superficial pustular perifolliculitis, is characterized by development of cone- or hemisphere-shaped pustules, the size of a millet grain or a pea, surrounded by a hyperaemic oedema with a hair in the centre The pustules dry in a few days into dense grey-yellow crusts The disease usually attacks the flexures of the extremities and the haired portions of the head

Folliculitis is caused by staphylococci and begins with development of pustules at the orifice of the hair follicle (ostiofolliculitis) Deeper portions of the hair follicle then become

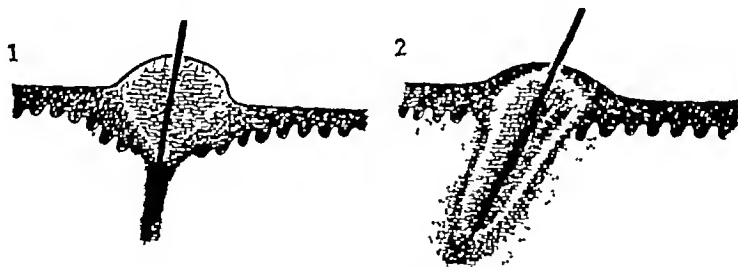


Fig 14 Development of pyoderma  
1—osteofolliculitis, 2—folliculitis

involved, the cone-shaped pustule is strained and rests on a dense base The affection has the size of a pin head (to the size of a hemp), the infiltration is the size of a lentil or a pea A furuncle or a carbuncle may develop from folliculitis (Figs 14, 15)

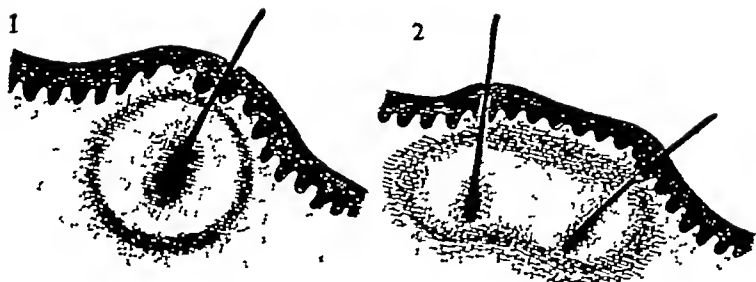


Fig 15 Development of pyoderma (continued)  
1—furuncle, 2—carbuncle

Sycosis is a persistent chronic disease tending to relapses. It is caused by staphylococci (simple, nonparasitic sycosis). This is the inflammation of the hair follicles, especially of the beard and mustache, less frequently of other haired parts of the body. The affected sites contain ostio-folliculitis, folliculitis, infiltration, pus crusts, hairs are easy to pull out, or they fall off spontaneously.

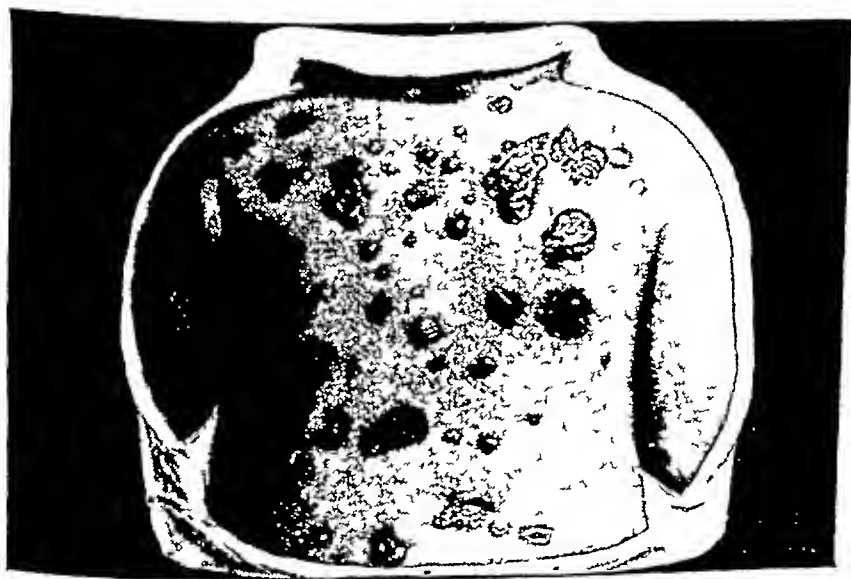


Fig 16 Pemphigus of the newborn



Shaving in inadequate conditions and general slovenliness favour the development of the disease. Lengthy course of sycosis is explained by deep changes in the body reactivity associated with dysfunction of the nervous system and endocrine (mainly sexual) glands, abuse of alcoholic drinks, etc.

**Pemphigus neonatorum** (impetigo of the newborn) The disease is caused by streptococcus. It occurs in neonates during their first weeks and months of life. The disease is very contagious and therefore occurs epidemically in lying-in hospitals and nurseries. Flaccid vesicles (the size of a pea or a cherry) appear on the skin. The vesicles may appear on any part of the body, they contain seropurulent liquid and are surrounded by a hyperaemic spot (Fig. 16). The thin cover of the vesicles soon collapses to form scarlet lesions. The vesicles may develop on the mucosa of the mouth, nose, genitalia, and the eyes. The newborn is restless, it cries, the appetite and sleep are deranged, the temperature may be elevated.

### Deep Pyoderma

**Furuncle and furunculosis** Furuncle is a deep follicular pustule formed in a hair follicle with involvement of the corium and the surrounding cellular tissue. Furuncle begins with ostiofolliculitis which promptly propagates to deeper tissues to form a dense and painful nodule, the size of a nut (or a walnut), with a red surface. The furuncle opens on its centre to discharge large amount of yellow-green pus. Necrotic tissue round the hair follicle forms a 'core' which is separated in 1-2 days. The wound margins are hyperaemic and oedematous, the bottom is covered with bright granulation. Furuncles leave cicatrices on the skin. The disease is caused by staphylococcus.

The occurrence of a number of furuncles in a patient is known as *furunculosis*. The furuncles appear one after another and develop simultaneously. The disease usually occurs in asthenic persons with deranged carbohydrate metabolism (diabetes) and gastrointestinal disorders. If furuncles occur on a localized site of the body, furunculosis is referred to as *local*, while *general* furunculosis implies development of

furuncles over various parts of the body. Acute and chronic furunculosis are differentiated, the latter persisting for months and years.

**Carbuncle** is caused by staphylococcus. This is a purulent inflammation of several adjacent hair follicles. The carbuncle consists of several furuncles which fuse into

a single infiltration. The consistency of a carbuncle is firm and the surrounding skin is oedematous. The colour is cyanotic-red. A carbuncle is painful and its development is attended with pyrexia (to  $40^{\circ}\text{C}$ ), headache, loss of appetite and insomnia. After the carbuncle ruptures and its contents drained the ulcer heals leaving a deep scar. Carbuncles occur in asthenic persons, mostly on the posterior surface of the neck and in the lumbar region.

**Hydradenitis** is also caused by staphylococcus. This is an acute purulent inflammation of apocrine sweat glands and the adjacent subcutaneous connective tissue. Most common location of hydradenitis is the armpit, less frequently it occurs in the genital and anal regions. The onset of the disease is manifested by formation of an almost painless nodule (the size of a pea) in the subcutaneous connective tissue. The nodule gradually increases in size to become more painful, and the overlying skin reddens. The adjacent apocrine glands become involved in the process and new nodules develop (Fig 17). Nodules at their various stages fuse into one general infiltration topped with red papillae of varying size which are actually tops of separate abscesses. The nodules then soften and discharge considerable amounts of cream-like pus. Each nodule develops for 2-3 weeks.

**Pseudofurunculosis** or multiple abscesses in children. Pseudofurunculosis is a staphylococcal affection of the glomerules and ducts of sweat glands in asthenic or slovenly infants. Fluctuating abscesses are formed deep in the corium and do not open for lengthy periods of time. The overlying skin

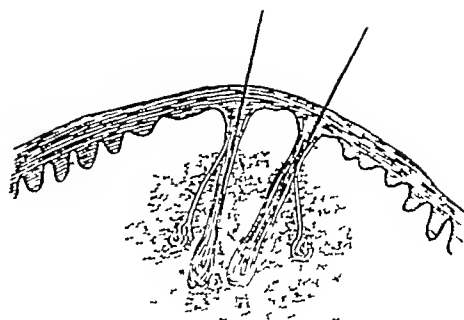


Fig 17 Hydradenitis

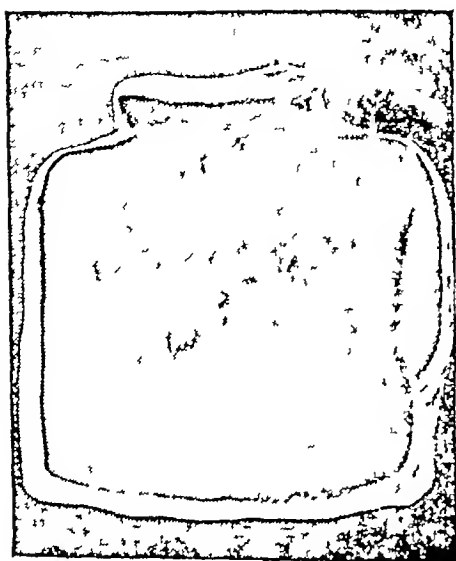


Fig 18 Multiple abscesses of the skin in children (pseudofurunculosis)



Fig 19 Ecthyma

is first of normal colour but then becomes red and cyanotic (Fig 18) When the nodules open, no cores of necrotized tissue can be found The disease usually attacks the spine and the buttocks, the haired portion of the head is also involved

*Ecthyma vulgaris* (streptococcal) is a deep form of streptococcal impetigo rested on an oedematous base The lesion is usually located on the legs, less frequently on the thighs, buttocks, and in the lumbar region of asthenic patients living in slovenly conditions The pustules have the size of a nut, these are flaccid formations with seropurulent contents, surrounded by cyanotic-red indurated tissue The pustules develop into yellow-dirty crusts, which fall off to leave deep and painful rounded ulcers with a suppurative bottom (Fig 19) On healing the ulcer always leaves a scar The disease continues for weeks, sometimes months

## Treatment of Pyoderma

Pyogenic diseases of the skin are treated by general and external means, physiotherapy, and obligatory observation of the regimen. The status of the internal organs and the central nervous system should be examined in patients with chronic and recurring pyoderma and, if indicated, these diseases should be treated.

### General Therapy of Pyoderma

Immunological treatment is indicated in all forms of deep pyoderma, sycosis, persistent and recurrent folliculitis and impetigo. Substances used in *specific* immunotherapy are staphylococcus toxoid, staphylococcal antiphagin, staphylococcal bacteriophage, strepto- and staphylococcal vaccines (polyvalent or autovaccines). Treatment may be attended with chills, pyrexia, malaise, exacerbation in the foci of affection and redness, oedema, and pain at the site of injection of the preparation. Each next injection should be done only after disappearance of the general, local or focal reaction. Means of *nonspecific* immunotherapy are auto-transfusion of blood, milk injections, injections of gamma globulin, transfusion of native plasma and blood (for details see 'Basic Principles of Treating Patients with Skin Diseases' and 'Immunotherapy' below).

**Antibiotics** Before prescribing a particular antibiotic, the culture of streptococcus or staphylococcus should preferably be isolated and the sensitivity to various antibiotics determined. If it is impossible to determine sensitivity of the micrococci, antibiotics having a wide effective range should be prescribed. Penicillin should be given intramuscularly in a dose of 100 000-200 000 units (water-soluble crystalline powder) 3-4 times a day or ecmonovocillin (600 000 units, once a day), bicillin-3,-5 (600 000 units into each buttock, once in 4-5 days), for a total of 2 000 000-5 000 000 units per course. Penicillin is sometimes used together with streptomycin (500 000 units two times a day).

Erythromycin and levomycetin are given in 0.5 g doses 3-4 times a day, in a total of 8-15-20 grams per course. Chlor-tetracycline hydrochloride, oxytetracycline dihydrate (ter-

ramycin) and tetracycline are given in a dose of 0.2 g 4-5 times a day for a total of 5-10 g per course. Sigmamycin and neomycin sulphate are manufactured in capsules and in solution form (syrup) and are therefore used for treatment of children. Oleandomycin is given in a dose of 1 000 000-2 000 000 units a day (4-6 times a day in equal portions). The group of antibiotics with a wide effective range comprises albomycin, rondomycin, tetraolean, and others. Vitacycline contains tetracycline and vitamins C, B<sub>1</sub>, and B<sub>2</sub>.

Some patients will not tolerate antibiotics, which can cause complications and allergic response. Desensitizing and antihistaminic preparations should then be given. Antibiotics have only slight effect on immunity and they can therefore be combined with immunotherapy. Synthetic preparations oxacillin, methicillin, etc., are also used.

Sulpha drugs have been used less frequently in recent years because of significant allergizing effect and toxicity. They are contraindicated in hypersensitivity, intolerance, blood diseases, and diseases of the liver and the kidneys.

Norsulphazole, sulphadimezine, ethazole are given per os in a dose of 1 g 3-4 times a day (for 5-10 days), sulphapyridazine and sulphadimethoxine (madribon) are given in 1-1.5-2 g doses per day (for 7-14 days).

General tonic preparations are very important in treatment of patients with pyoderma. Ascorbic acid, vitamins of B complex (B<sub>2</sub>, B<sub>12</sub>), nicotinic acid, rutin, preparations of iron and phosphorus (phytin) are prescribed. Food should be rich in proteins, vitamins, the intake of carbohydrates should be limited, while salt food and alcoholic drinks are prohibited.

### External (Local) Treatment of Pyoderma

All superficial circumscribed pyogenic affections should be treated externally (locally). The skin around the affected foci should be wiped with 1-2 % borosalicylic or 1-2 % salicylic-camphor alcohol. Bath or douche is not recommended since they may favour propagation of the process. The rest of the skin should therefore be also treated with the medicinal solutions. The nail phalanges of children should be treated with a 2 % iodine tincture.

Covers of the pustules in patients with impetigo, folliculitis, pemphigus of the newborns, etc., should be cut off by scissors and pus removed from the pustules with cotton wool. The pustules of patients with ostiofolliculitis should be punctured with a sterile needle and the cover cut off by scissors. Firmly attached crusts should be softened with vegetable oil and removed by forceps in 15-20 minutes. Erosions should be treated with 1-2 % aniline dye solutions (methylosaniline chloride, methyl violet, or brilliant green) in 70° alcohol, or with Castellani's paint. One of the following disinfecting ointments should then be applied: 5 % colimycin, dibiomycin, 0.5-1 % or 5 % erythromycin, 2-5 % polymyxin, 3 % biomycin or 1-3 % tetracycline ointment. A 2-3 % yellow mercury oxide ointment, 3-5 % white mercury, 5 % dermatol or xeroformic ointments, 2-3 % boric acid-tar ointment, an aqueous paste of white streptocide are still used in dermatological practice. Emulsions and ointments containing corticosteroids together with antibiotics such as oxycort, geocorton, locacorten, dermosolon have recently come in use.

Patients with persistent sycosis have their hair plucked out by an epilating forceps (in addition to treatment with general and external means). Shaving should be prohibited. The adjacent unaffected portions of skin should every day be treated with 70° alcohol or vodka.

An aqueous paste of sulphur drug (streptocide, etc.) should be applied to ulcers of patients with ecthyma and chronic ulcerous pyoderma. Phlyctenae, which form ecthymas, are punctured to release the exudate, crusts are removed by placing bandages with salicylic, xeroformic or ichthammol ointments.

Pure ichthammol is often used to treat furuncles, carbuncles, hidradenitis and pseudofurunculosis in children. Ichthammol is applied in a thick layer to the affected site and a thin layer of cotton wool is placed atop. The following ointments are then used: oxycort, geocorton, dermosolon or boric acid-tar ointments. In furunculosis, after disinfection of the skin around the furuncle with alcohol, ether or petrol, the hair is pulled out carefully by a forceps and pure ichthammol applied.

*Physiotherapy of Pyoderma.* Exposure of patients with fu-

runculosis and folliculitis to the light of a quartz mercury lamp (in the autumn and winter in particular) is very helpful. Incipient forms of furuncle and hidradenitis are treated by exposure to erythema or supererythema doses of ultra-violet radiation or UHF currents.

### Prophylaxis of Pyoderma

Personal hygiene of patients with pyoderma and healthy persons is the decisive factor in prevention of spreading of pyoderma. The surface of the skin and the pus of a patient with pyoderma contain large amounts of pathogenic cocci. The patient should have individual linen and a towel, which should be boiled after use. Dressing materials used by the patient should be burned.

In addition to means of individual prophylaxis, measures of collective prophylaxis should also be taken. Health education is among them.

Pyodermic infections are especially dangerous in children's institutions. Children with pyoderma should immediately be isolated from the others and allowed to join them only after complete recovery.

Works posts in industry should be kept clean and medical workers should supervise all sanitary measures. Whenever necessary, administration and public opinion should be involved.

Sanitary posts equipped with means for first aid in cases of minor injuries should be available at enterprises. Medical personnel should supervise the work of showers, cleanliness of overalls, and their timely renewal, etc.

Special care should be taken to prevent minor injuries (which are decisive in the development of pyoderma) in industry and agriculture. All minor injuries should immediately be treated with 1-2% solutions of aniline dyes or iodine. The skin should be protected from contact with mineral oils or chemicals, measures should be taken to preclude hyperhidrosis, maceration of the skin, and exposure of the body to cold.

The Paikin method is widely used, it consists in taking a shower at the end of the work shift, and in keeping the hands in ammonia spirit solution for five minutes (10 ml

of the spirit dissolved in 2 litres of lukewarm water) The skin should then be dried up using a towel (without rubbing) and vaseline applied to the hands

General tonic measures are hardening, sports, walks in fresh air, adequate sleep, well organized work-day, and proper nutrition

Health education is another important factor in control of pyoderma This includes lectures and talks of medical workers, placards, booklets, etc Medical nurses should have talks with industrial and agricultural workers, at schools, hostels, etc , to explain people causes of pyoderma, the harm of this disease to the man and people's economy due to transient disability, etc People should be taught how to follow rules of hygiene The importance of timely medical consultation and the danger of self-treatment should be explained

### *Review Questions*

22 Which of the following symptoms characterize staphylococcal pyoderma (1) flat flaccid pustules, (2) tense pustules, cone- or hemisphere shaped, (3) affection of hair follicles and sweat glands?

23 Choose the correct symptoms of streptococcal pyoderma (1) flat flaccid pustules, (2) tense conical or hemispherical pustules, (3) affection of hair follicles and sweat glands

24 Superficial pyodermas are (1) impetigo, (2) furuncle, (3) hidradenitis, (4) folliculitis, (5) sycosis Choose the right ones

25 Baths and showers are permitted in superficial pyoderma Yes or no?

26 Shaving is allowed in sycosis Yes or no?

27 Ichthammol *per se* can be used to treat furuncles, carbuncles, hidradenitis, and pseudofurunculosis Yes or no?

### MYCOSES

Causative agents of mycoses are pathogenic fungi parasitizing on the skin and its appendages Infection spreads through contact between people and between man and animal Infection may also be transmitted through objects contaminated with pathogenic fungi



Four groups of mycoses are differentiated keratomycoses, dermatomycoses, candidiases, and deep mycoses. The latter are rare diseases.

### Keratomycoses

This group comprises pityriasis versicolour and erythrasma\*. These diseases are not very contagious, they attack only the upper layer of the epidermis and do not cause inflammation of the skin.

Pityriasis versicolour is marked by development of yellowish or brownish macular patches on the upper part of the trunk which absorb readily iodine tincture (iodine test). Erythrasma is characterized by the development of brownish or yellowish-red scalloped patches, located mostly in the groins, on the anterior surface of the thighs, under the mammary glands and in the armpits (Fig 20).

These are persistent chronic diseases. Their treatment consists in rubbing in alcoholic solutions containing 3-5% salicylic acid or resorcinol, and ointments containing 10-20% sulphur. Erythromycin ointment (5%) is also helpful.



Fig 20 Erythrasma


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\* Most authors believe that erythrasma is caused by *Corynebacterium*, while the disease itself is referred by them to pseudomycoses (skin diseases caused by bacteria).

## Tropical Keratomycoses

*Imbricated mycosis* occurs mainly among the residents of the coasts and islands of the Pacific. Incidence of this disease among the population of the Soviet Union who visited India, China, and Burma was reported. The disease is characterized by the involvement of the superficial layers of skin. The foci resemble scales of fish, they form dark brown rounded patches (fish skin). Desquamation begins from the centre, where the horny layer partly detaches. A pigmented crown-like formation can be seen by the periphery of the scaly patch. Multiple concentric scaly patches of intricate shapes are formed. All skin is quickly affected (except the haired part of the head). The nails thicken and become brittle. The disease is attended with strong itching. Marked inflammation is absent. Treatment consists in regular baths with subsequent treatment of the affected skin by pumice and 10% chrysarobin ointment, griseofulvin therapy is also helpful. Relapses of the disease are frequent.

*Shimbery* resembles imbricated mycosis in its clinical picture but it affects mainly the face, and less frequently the trunk and the extremities. Occurs in India, Ceylon, Indochina. Hyperhidrosis, slovenliness and infectious diseases favour the development of the disease, children are less frequently affected. Silvery-brown slightly scaling patches are formed on the skin of the face, neck, and the anterior surface of the chest. The affection is not inflammatory. The foci increase in size rapidly through peripheral growth. The scales fall off at the centre of the patch to leave a discoloured spot. The nail plates often become dull and disfigured, they easily break. Keratolytic ointments with salicylic acid, chrysarobin and resorcinol are used for treatment. External use of alcoholic solutions, control of hyperhidrosis, and keeping the body clean are especially indicated. Griseofulvin therapy is sometimes used as well. The prognosis is favourable.

*Miliaria alba* occurs in Africa, India, Indonesia, Thailand, and Burma. The disease is marked by polymorphic eruptions on the skin of the extremities. They leave persistent depigmentation of polycyclic shapes. Small erythematous papules first appear on the  and the soles, less frequently on

the forearms and legs. The onset is marked by itching. The papules soon turn into vesicles. Their contents promptly turn turbid and then seropurulent. The pustules open to form erosions with silvery-white margins of epidermis by the periphery. Small foci of depigmentation appear on the formerly affected sites in a few months and sometimes years. They propagate slowly but steadily to turn into an intricate pattern on the darker unaffected skin. Achromia develops completely in 4-5 years. Itching discontinues by that time. Symmetrical eruption patterns are characteristic of this disease. Griseofulvin is used to treat miliaria alba. Keratolytic preparations, 1-2% solutions of aniline dyes are applied externally. The prognosis is favourable, but achromia is persistent.

*Tropic yellow pityriasis* (yellow microsporiasis, parasitic achromatosis, Castellani's yellow lichen, tropic achromia). Occurs only in tropic and subtropical countries (Indochina, Brazil, Ceylon, Madagascar, Cuba, and less frequently Africa). The disease occurs in summer, especially during the time of maximum humidity. Adults and children are equally affected by the disease. Epidemics among children are not infrequent. Small yellow-orange patches appear on the skin of the face, and neck, the other parts of the body are less frequently attacked. Subjective symptoms moderate itching. The patches increase in size to fuse into larger patches with polycyclic margins. The lesion is marked by desquamation. New ('daughter') foci often develop by side of the old patches. The disease differs from pityriasis versicolour in that it is contagious for children, affects the skin of the face, and the foci are yellow with an orange tint. Treatment 5% sulphur ointment, 1-2% chrysarobin, 3% salicylic, other antiparasitic ointments.

*Tropic black pityriasis* (black microsporiasis, black keratomycosis of the palms). The disease occurs in Central and South America, in Africa, less frequently in Asia. The disease is contagious (may be familial). Hyperhidrosis and slovenliness are the predisposing factors. The onset of the disease is marked by dark-brown or black macular patches on the palms and the soles characterized by moderate desquamation and itching. This localization is characteristic of Central

and South America In the East hemisphere the disease attacks the neck and the upper portion of the chest The patches fuse into large maculae (to a few centimetres in diameter) of polycyclic shapes The nails and the hair are not attacked Treatment various keratolytic ointments with resorcinol, sulphur, salicylic or benzoic acid, or alcoholic solutions containing 3-5% resorcinol and salicylic acid The prognosis is favourable

### Dermatomycoses

This group includes epidermophytosis, rubromycosis (rubrophytosis), trichophytosis, microsporia and favus These diseases affect the horny layer of the skin, the hair, and nail plates Fungi of this group cause inflammatory response **Epidermophytosis of soles.** The disease is caused by *Epidermophyton* It attacks the folds between the toes, soles, and the nails The disease is infectious Baths, showers, swimming pools may become the source of infection because the fungi contained in the desquamated scales can live for considerable time in the carpets, door-mats, wood grates, and stagnant water Bed, footwear, socks, or other objects that might be in common use, are another source of contamination Hyperhidrosis, flat-foot, intertrigo and various lesions of the skin favour the infection

Epidermophytosis of soles is a persistent disease, exacerbating in spring and summer (with increased perspiration)

Several clinical forms are differentiated

The *squamous form* of the disease is marked by the appearance of scaly desquamation in the region of the instep attended with inconsiderable itching The prerequisite condition for establishing the diagnosis is identification of the fungus (microscopically) The *intertriginous form* is characterized by desquamation, cracks and weeping between the fifth and the fourth, and between the fourth and the third toes Superficial erosions are surrounded by a whitish margin of the epidermis The subjective symptoms strong burning and itching The *dyshydrotic form* is manifested by deep vesicles, the size of a millet grain or a pea, these are dense and located in the region of the instep The vesicles fuse



Fig 21 Dyshidrotic epidermophytosis.

into larger ones, collapse to form erosions with whitish macerated epidermis by the periphery (Fig 21) The affected nails (of the first and the fifth toes) become dark-yellow, thick, and brittle Allergic eruptions on the hands, trunk, and legs in the form of scales, maculae, vesicles or nodules (epidermophytids) often occur in epidermophytosis

If secondary infection develops together with epidermophytosis, secondary pyoderma, erysipelatous inflammation, and lymphangitis may occur

*Treatment* Patients with the intertriginous and dyshidrotic forms of epidermophytosis, and also with epidermophytids are given general desensitizing treatment (see 'Basic Principles of Treating Patients with Skin Diseases') Warm baths for feet containing potassium permanganate are recommended Using scissors, vesicle covers are removed and a lotion with a 0.1% solution of rivanol (ethoxydiamino-acridine lactate) or resorcinol (1-2%) solution should be applied After the acute symptoms subside, undecine, zincundane, and amycazole ointments should be used Nitrofungin can also be used

Berezhnoy's fluid (2 g of iodine, 2 g of sodium iodide, 20 ml of glycerol and acetic acid (20 or 40%) to make 100 ml) is used in the squamous form of the disease the affected sites are treated for 15-20 days and then, for the purpose of prophylaxis, with a 2% alcoholic solution of iodine for a month



Fig 22 Rubromycosis

The footwear should be disinfected the inner surfaces of the shoes should be wiped with a 10% solution of formaldehyde and kept in a polythene bag for 1-2 days, after which they should be aired for 12-24 hours

In order to preclude the disease, the feet should be kept clean, hyperhidrosis and flat-foot treated properly, possible intertrigo prevented, and rules of personal hygiene (individual bed, footwear, socks, stockings, etc ) observed properly. Although special prophylactic measures are taken in public bath-houses, swimming pools, etc (the benches, carpets, wood grates, etc are disinfected, and the personnel is given health education), it is nevertheless recommended to wear rubber slippers (shoes)

Rubromycosis (rubrophytosis) has been only recently classified as a specific affection. As distinct from epidermophytosis, this disease attacks not only the soles but the palms, and other parts of the skin as well (Fig 22). The process is generalized in patients with endocrine disorders in particular. All nails on the fingers and toes may be attacked as well. The horny layer of the palms and the soles thickens, becomes pink, with distinctly seen skin furrows in which fine desquamation can be observed. The affected nails become yellow, opaque, thick, and brittle.

Epidermophytosis, candidiasis and rubromycosis of soles have in recent years been classified as 'mycoses of the soles', the incidence of rubromycosis prevailing over epidermophytosis and candidiasis of the soles.

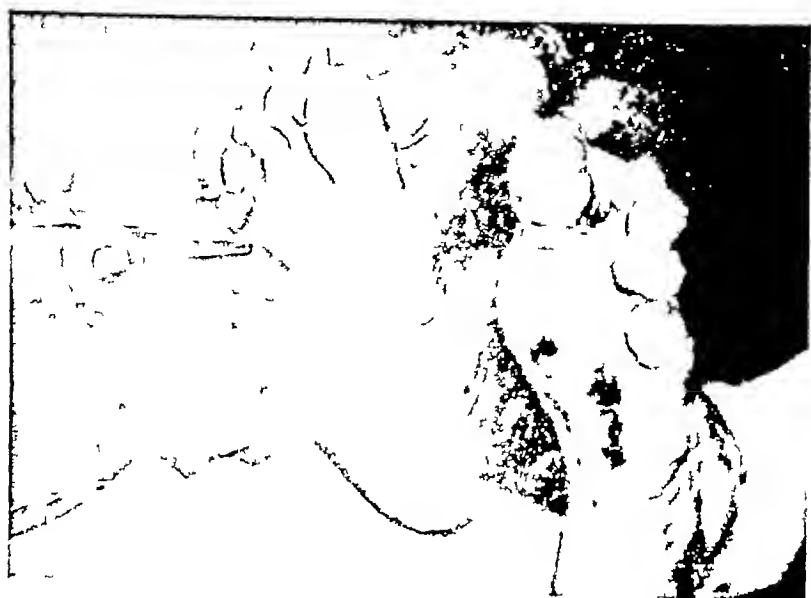


Fig 23 Separation of the horny layer after using ointment

*Treatment* Patients are given griseofulvin. Desquamating (Fig 23) and disinfecting ointments (with high concentration of salicylic and lactic acids and resorcinol) are used externally (For treatment of nail plates see 'Treatment of Patients with Dermatomycoses' below )

#### TRICHOPHYTOSIS, MICROSPORIA, AND FAVUS

Fungi of this group attack the horny layer of the skin, sometimes hair and nails (The ability to attack hair distinguishes these fungi from the others ) The skin is always inflamed, the response being more pronounced if the main host of the fungus is the animal and less marked if the fungus parasitizes only on the skin (and its appendages) of man. Trichophytosis has several forms superficial, chronic (the fungi causing this form parasitize only on man) and zoophilic (deep) The fungi causing the latter form parasitize on the skin of the animals, such as calves, cows, less frequently horses, mice, rats, and still less frequently, rodents

and man Microsporia may be caused by *Microsporum lanosum* (parasitizing on cats, less frequently on dogs and man) and by *Microsporum ferrugineum* (parasitizes on the skin of man only) Favus attacks man and some animals and birds

**Epidemiology.** Dermatomycoses that are caused by the fungi parasitizing on the skin and its appendages (superficial and chronic trichophytosis, microsporia caused by *Microsporum ferrugineum*, and favus) are transmitted through direct contact with the infected man or through the agency of domestic utensils and other objects, such as combs, hats, clothes, bed, etc., upon which hairs, scales or crusts bearing mycelium hyphae or spores of the fungi might remain Trichophytosis may be familial the children get infected from the adults through every-day contact Favus is transmitted in prolonged contact in the family where rules of hygiene are neglected

Dermatomycosis caused by fungi parasitizing on man and animal (zoophilic, or deep trichophytosis, and microsporia caused by *Microsporum lanosum*) is transmitted by direct contact with affected animals (calves, cats, etc.) and with objects on which the animals might leave hairs (mice and rats), scales, or from infected people and the objects with which they come in every-day contact Parasitic sycosis may be transmitted at hairdresser's and barber's where rules of hygiene are not properly observed

Superficial trichophytosis is caused by the fungus *Trichophyton endothrix* The fungus owes its name to the fact that the spores and hyphae of the mycelium are found inside the hair shaft (from *Green endon* within and *thrix* hair) This is well seen in the microscope (Fig 24) The large spores are arranged in longitudinal chains

Superficial trichophytosis attacks usually infants and children, adults and children over 16-17 get infected very seldom The disease is marked by the appearance of small rounded or oblong pale-red foci covered by bran-like scales They appear on the *haired part of the head* and the affection is not general The affected hair breaks at a height of 1-3 mm from the surface of the skin and the site resembles a moth-eaten fur (Fig 25) The disease is prolonged If untreated, the patient recovers spontaneously during sexual maturation



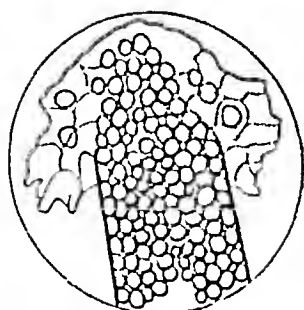


Fig 24 Trichophyton endothrix



Fig 25 Trichophytosis of the head

tion, or the disease becomes chronic. *Smooth skin* is affected either simultaneously with the hair of the head, or independently. A rounded pink-red macula develops on the skin. The margins are pronounced, while the centre becomes pale and covered with bran-like scales. A hyperaemic ridge is formed by the periphery of the focus upon which vesicles (the size of a pin head) and crusts are formed. The maculae increase in size and may fuse to form a large focus with festoon (scalloped) margins. Open parts of the skin would usually be affected. The *nails* are affected in about 2 per cent. They become rough, dirty-grey, and very brittle.

**Chronic trichophytosis** This disease occurs usually in women. The causative agent is the same as in superficial trichophytosis. Diseases of the nervous system, endocrine glands, and menstrual dysfunction favour the transition of superficial trichophytosis to the chronic form. Small alopecia foci with dandruff are formed at the temples and on the back of the head. The hairless spots are covered with 'dots' of hairs broken at the skin level. Small scars can also be found on the affected sites. The smooth skin (usually of the buttocks and the legs) develops symmetrical foci of stagnant cyanotic colour with indistinct margins and moderate scaling. Nails (all or only part of them) are attacked in 20 % patients.

**Zoophilic (infiltrative-pyogenic, or deep) trichophytosis** This form was formerly known as deep or pyogenic trichophytosis. At the present time superficial (in 1/3 cases) and infiltrative (almost in 1/3 cases) foci are observed in patients with this disease, and it would now be usually referred to as zoophilic or infiltrative-pyogenic trichophytosis, i.e. trichophytosis caused by the fungi parasitizing on the skin of the animals. The causative agent is *Trichophyton ectothrix* (from Greek *ektos* outside) called so because it is normally found on the surface of the hair. *Trichophyton ectothrix megalosporon* attacks cows, calves, horses, while *Trichophyton ectothrix microsporon* parasitizes on mice and rats. Man can be infected with *Trichophyton microsporon* from horses, calves, sheep and other animals, because large animals can in turn be infected by the rodents. The spores of *Trichophyton ectothrix* form long chains on the outer surface of hairs.



Fig 26 Zoophilic trichophytosis

A large focus is formed on the *haired part of the head infected with Trichophyton ectothrix*. The focus is marked by significant hyperaemia, infiltration, and many pus crusts (Fig 26). When the crusts are removed, follicles excreting pus can clearly be seen. The pus looks like honey emerging from the comb. The foci are therefore called kerions (Greek *kerion* honeycomb). The disease is acute, with elevated temperature, headache, burning in the focus, and enlargement of the adjacent lymph nodes. As has been said above, inflammatory response may be absent in zoophilic trichophytosis, and the foci can then have insignificant infiltration without

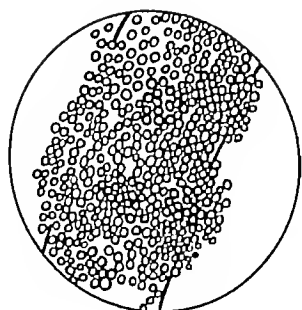


Fig 27 Microsporum



Fig 28 Microsporia of the head

pus crusts. The diagnosis is established by the pattern of fungus location on the hair. Zoophilic trichophytosis of the beard and mustache is called parasitic sycosis, as distinct from non-parasitic (staphylococcal) sycosis. If not treated, the disease ends spontaneously in several months to leave a cicatrix and complete or partial loss of hair.

Single foci are formed on open portions of the skin. They develop in the same way as on the haired portion of the head.

**Microsporia.** The disease is caused by the fungi *microsporum*, whose small spores are arranged at random, forming no chains on the outer surface of the hair (ectothrix), and enclose the hair into a sheath (Fig 27).

*Microsporum lanosum* parasitizes on the skin of cats, kittens, less frequently on the skin of dogs, *Microsporum ferrugineum* parasitizes on man only.

*Microsporum lanosum* attacks mainly children under 14. One or (less frequently) several large circular or oblong foci with distinct margins and covered with bran-like scales are formed on the haired part of the head (Fig 28). All hairs in the foci are attacked, they break at the level of 5-8 mm above the skin level. A white sheath can be seen at the hair

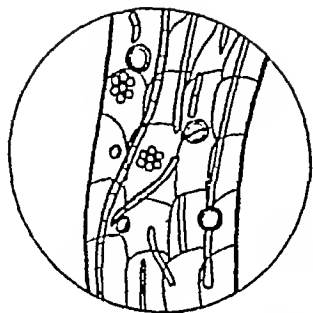


Fig 29 Schoenlein's achorion (*Trichophyton schoenleinii*)

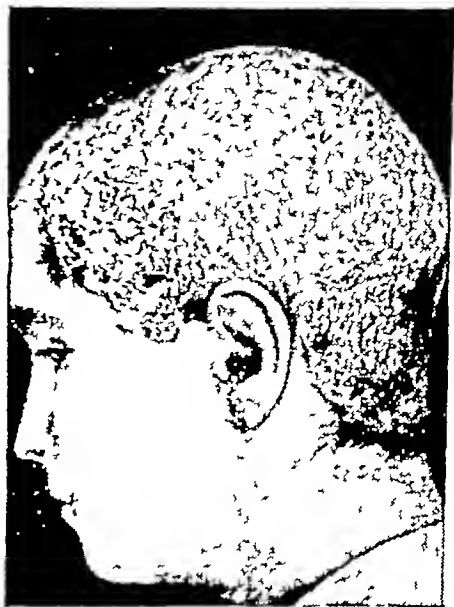


Fig 30. Favus of the head

root, this is formed by the spores which surround the hair root

*Microsporum ferrugineum* causes microsporia in man only. The disease is highly contagious and epidemic outbreaks occur among children. Scaling foci of variable size and shape develop on the haired portion of the head. The foci fuse into larger ones with indistinct margins. The hairless skin is often involved in the process as well. The shapes of the foci are often intricate: concentric circles, arches, garlands, etc. The hairs are broken at a level of 5-8 mm above the skin level.

Microsporia of hairless skin often resembles superficial trichophytosis of hairless skin, but the number of foci in microsporia lanosum may be as high as a few dozens while in microsporia ferrugineum they may have intricate shapes. Hair attacked by microsporum can give green luminescence during irradiation in a dark room with a quartz mercury

lamp with a luminescent filter This phenomenon is used for diagnostical purposes

**Favus** The fungus *Schoenlein's achorion* (*Trichophyton schoenleinii*), that causes favus, parasitizes on man only It is found on the skin and its appendages and resides inside the hair (endothrix) It may differ in size and shape of the mycelium hyphae and the spores (Fig 29)

Favus is less contagious than microsporia or trichophytosis It attacks children, but may persist throughout the entire adulthood

Ochre-yellow crusts with indentation in the centre (scutula) are formed on both haired and hairless parts of the head skin A hair passes through the centre of the scutulum When the scutulum falls off, persistent atrophy develops on the affected site and the hair does not grow on it The hair does not break but becomes dull, grey, as if covered with dust, and resembles a wig If all hair on the head is attacked by the disease, a thin margin of healthy hair still remains by the periphery of the haired portion of the head (Fig 30) The hair smells of mice or granary The affected nails become thick, rough, dirty-yellow and brittle

#### LABORATORY DIAGNOSIS OF DERMATOMYCOSES

Microscopic and cultural diagnosis of mycoses should be established by physicians or specially trained secondary medical workers

Nurses often have to take pathological material for laboratory analysis (for microscopic diagnosis) The result of the laboratory analysis depends on the skill of the nurse and the method by which the material is delivered to the laboratory

The medical nurse should know what particular material should be analysed in this or that mycosis The card accompanying the sample should be properly filled in and comprise the necessary information, viz, the name of the patient, case history No., the name of the material (sample) sent to the laboratory, the object of the analysis and the expected diagnosis.



Fig 31 Taking material from the focus periphery for laboratory test for fungi

In superficial trichophytosis, hair stumps (remnants of the broken hair) should be taken for microscopical examination. If the hair remnant is hidden under the scale, the latter should be energetically detached from the skin by an epilating forceps. The back of the scale would usually bear the broken hair, or it may remain on the skin of the head.

Hair broken at the skin level should be taken for laboratory examination in chronic trichophytosis. The procedure is not easy to perform. Using a needle, the hair remnant should be tried to extract from its follicle, if this fails, the hair should be expressed by the fingers from the follicle to a few millimetres until it can be grasped by the epilating forceps.

In suspected zoophilic trichophytosis, the hair for examination should be taken from the peripheral parts of the focus because the fungi may undergo lysis by pus which is present in the centre of the focus.

In microsporia of the haired part of the head, hair broken 5-8 mm over the skin level should be taken for analysis. Hair remnants having white sheaths at their base (the spores of the fungus) should be taken.

In favus of the haired part of the head the hair with sharply changed appearance (dull, grey, as if dusted, lacking natural lustre, resembling a wig) should be taken for analysis

If the process is localized to the hairless skin, a sample of a peripheral ridge (Fig 34) should be scraped off for examination for the fungus. An adhesive tape is sometimes attached to the skin 1-2 days before scraping off

When the nail plates are affected, the upper layers are scraped off using a scalpel (trichophytosis and yeast affections) and the middle portions of the nail plate are scraped in other cases. A drilling machine used in dentistry may be employed for taking nail samples, if the marginal end of the nail is affected, it can be cut off by scissors

### Treatment of Dermatomycoses

Patients with dermatomycoses are treated by various methods depending on the location of the foci, gravity of inflammation, and the age

Antifungal preparation griseofulvin (0.125 g tablets) is used to treat patients with affected *haired portion of the head*. The daily dose is 21-22 mg per kg body weight. The preparation is given three times a day during meal in a tea-spoon of vegetable or cod-liver oil. The hair should be shaven once a week because the antibiotic is deposited in the hair only at a height of 2-3 mm above the skin level. The head should simultaneously be treated with a 2% iodine solution (in the morning) and a sulphur-tar ointment, containing 10% sulphur and 3% tar (in the evening). Or the head may be washed in the morning with soap (with a brush) and a 2% iodine solution, Wilkinson ointment should be applied in the evening. Griseofulvin is given daily and the therapy is continued until two tests for the fungus are negative, then griseofulvin is given every other day for two weeks, and then twice a week, also for two weeks. If there are contraindications to griseofulvin (diseases of the blood, liver, kidneys, etc.), the hair should first be removed from the head by a 4% epilin plaster. To that end the hair is first shaven and then a thin layer of the plaster is applied mainly over the infected foci. The plaster is given to chil-

dren aged under 6 in a single session of 15-18 days. To older children and adults the plaster is given two times, the first plaster being renewed in 8-10 days. The dose depends on the weight of the patient's body, viz. 2-2.5 g to children weighing from 10 to 11 kg, 3-3.5 g to children weighing from 12 to 13 kg, 3.5-4 g to patients weighing from 14 to 15 kg, 4 g to patients weighing 16-17 kg, 4.5 g to patients weighing 18 kg, 5 g to patients weighing 19-25 kg, 5.5 g to 26-30 kg patients, 6 g to 31-35 kg patients and 7-8 g to patients weighing from 36 to 40 kg. Epilin plaster is given in hospitals only. Hair is removed over the entire head in about 20 days. During the period of time extending from the removal of hair till the beginning of growth of new hair, the head should be treated with a 2% tincture of iodine (during the day time) and with an ointment containing 10% sulphur and 2-3% salicylic acid, or 10-15% sulphur ointment and 3-5% tar ointment in the evening. After the hair is removed by the plaster or by forceps, the Arievich 'detachment' method is used. A thick layer of an ointment containing 12% salicylic and 6% lactic (or 3% benzoic) acid is applied to the head. (The concentration of the constituents should be halved for children aged under 6.) Waxed paper and cotton wool are placed atop the ointment and the head is kept bandaged for two days. Then a 3% salicylic vaseline should be applied for one day. Thus loosened horny layer should then be scraped off by the branch of the scissors while the remaining hair plucked out by the forceps. The 'detachment' should be repeated if necessary once or twice at a ten-day interval, during which the head should be washed every day and a 2-3% iodine tincture should be applied in the morning and Wilkinson ointment in the evening.

If griseofulvin or epilin plaster are absent, the hair may be removed by X-rays (in four doses). In 11-12 days after the patient has received the total required dose, the head should be washed daily with warm water and soap. Beginning with the 18th day, the remnants of the hair should be removed by forceps. An injection needle or a scalpel should be used to remove very short hair remnants. During manual epilation the traction effort should be applied in the direction of the hair growth so that the hair should not break.



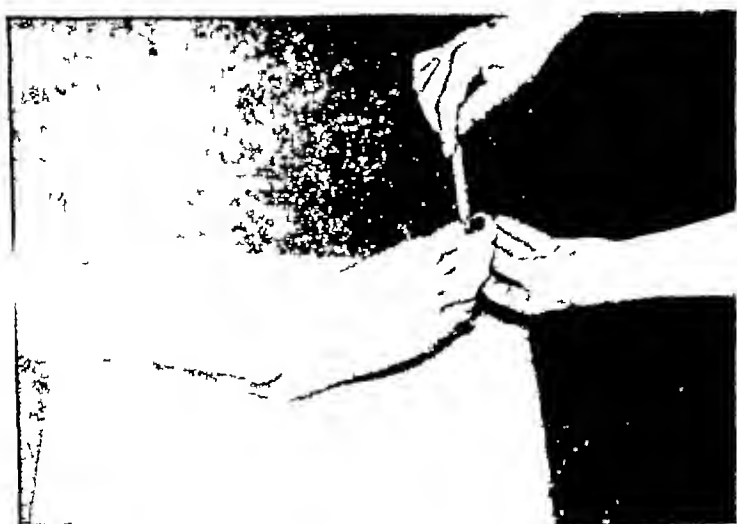


Fig 32 Applying fungicidal plaster to the nailbed

The epilation should be completed within 3-5 days. The further treatment is the same as the treatment with hair removal by epilator plaster.

If the affection is only local and the skin is *hairless*, a 2-3% iodine tincture should be used in the morning and a 10% sulphur-tar or Wilkinson ointment in the evening during the course of 7-10 days. In the presence of multiple foci on the skin or if lanugo is also involved in the process, griseofulvin is used.

In the treatment of *nails*, keratolytic plasters are first used (10% trichloroacetic, 50% salicylic, and 20% ureoplast). After softening and removal of the nail plate, fungicidal plasters (5% phenol, 5% betanaphthol, 5% thymol, 20% pyrogallol) are applied for 48 hours to the nailbed (Fig 32). Griseofulvin is given per os (daily for two weeks and twice a week during eight weeks). Nail plates may be removed surgically.

*Zoophilic (infiltrative, pyogenic) trichophytosis* of the haired part of the head and hairless skin is treated in a different way. X-rays, epilator plaster, 'detachment', iodine and ointments may cause sharp exacerbation of the process. The affected foci (and 1-cm wide margins round them) are de-

haired by an epilating forceps. Lotions with 5-10% ichthammol, 0.1% ethoxydiaminoacridine lactate (rivanol), furacilin (1:5000) are then used. When acute inflammation subsides, 10% sulphur-tar or Wilkinson ointment is prescribed. Griseofulvin has also been used in recent years.

Children are allowed to rejoin their group in kindergartens (and the like institutions) only after three successive negative tests for fungi. (The tests should be carried out at 7-10 day intervals after the therapy has been suspended.) The cured child should wear a cap on its head and all objects in the home of the cured patient should finally be disinfected.

### Prophylaxis of Dermatomycoses

Timely diagnosis, isolation and treatment of patients, and also revealing the source of infection, together with the examination of persons who had contacts with the patient, disinfection of the linen, clothes and other objects, as well as sanitary control of hair-dressers' and barbers', etc., are the main ways of prophylaxis of dermatomycoses. Because of the high contagiousity of microsporia (especially microsporia caused by *Microsporum ferrugineum*) and of trichophytosis, and also because of the difficult treatment of patients with chronic trichophytosis and diffuse forms of favus, these patients should be hospitalized. A zinc-gelatin cap is placed on the head of outpatients to decrease the danger of spreading the infection.

In cases with superficial trichophytosis, it is necessary to reveal adults with chronic trichophytosis in the family of the diseased child (mainly the mother, grandmother, or a nurse) and also diseased children in the kindergarten or the like institution. Cats and dogs with which the patient had contacts should be examined in cases with microsporia caused by *Microsporum lanosum*. In cases with zoophilic trichophytosis caused by macrosporum, cows, calves, horses and other animals should also be treated and animal farms should be disinfected. Mice and rats should be eradicated in cases with zoophilic trichophytosis caused by microsporum.

To disinfect the linen and clothes of the patients (during treatment), the articles should be kept in a 1% chloramine

solution or boiled for 15 minutes in the lye, followed by common launder After the treatment has been completed, all linen and clothes of the cured patient should be treated in paraformaldehyde chamber

All children at *nurseries*, *kindergartens*, *schools*, etc., should undergo monthly prophylactic examination Besides, all children newly-admitted to such institutions should undergo the examination as well Children returning after holidays (or absence for any other reason) should be examined as well The personnel of children's institutions and new employees should undergo monthly examinations All persons suspected for dermatomycosis should immediately be isolated from other children (personnel) and those with dermatomycosis should be hospitalized

*Cutting hair in children* Before cutting hair in children they should be inspected and the children with normal skin of the head have their hair cut first Children with reddened skin of the head, dandruff or crusts should have their hair cut next After each cutting of hair, the clippers should be held in the flame of an alcohol burner After cutting hair in children with suspected dermatomycosis, the clippers should be disassembled, cleansed, and its separate parts held in the flame of a burner

When a child with dermatomycosis has been revealed in a group of children in the kindergarten, school and the like, the other children should be examined once a week (during two or three weeks) In cases with microsporia, children should be examined once in 4-5 days during the course of 45 days

### CANDIDIASES (CANDIDOMYCOSES)

Candidiases are diseases of the skin and mucosa caused by yeast-like fungi of the genus *Candida*

Yeast cells of the genus *Candida* are constantly present on the mucosa and the gastrointestinal tract of healthy persons The cells are known as saprophytes and do not cause the disease They are also found on vegetables and fruits, especially on those that start decaying

If conditions unfavour (maceration, affection by acids or alkalis, etc., hypovitaminosis, disordered carbohydrate

metabolism, etc.), the body resistance decreases and the yeast becomes pathogenic. Its intense multiplication causes the disease. Yeast infection may also occur in upset microbial balance in the gastro-intestinal tract (dysbacteriosis), which may be due to antibiotics (especially antibiotics with a wide effective spectrum) and corticosteroid hormones.

Yeast-like fungi attack the skin, mucosa, nails, and the internal organs.

Large skin folds would usually be attacked (under the breasts, in the groin, and the armpits). Obese persons and patients with diabetes would usually be affected. Large red foci with whitish epidermis detaching by the periphery are formed. The foci have distinct margins and are surrounded by a large number of smaller affections. The patients complain of itching. Erosions between the fingers covered with a pearly-white film (Fig 33, a) often occur in housewives, venders of cooling drinks, in workers engaged in the manufacture of stewed fruits, vegetables, etc.

Any part of the mucosa may be affected but the most common form of candidiasis is thrush. It occurs mainly in asthenic infants and in patients with grave diseases treated by antibiotics and big doses of corticosteroids. Whitish patches, the size of a lentil, are formed on the mucosa of the tongue (Fig 33, b), cheeks, hard palate, and the tonsils. They grow to fuse into larger patches. The film is removed to show scarlet mucosa, sometimes eroded and therefore bleeding.

The nails are affected together with the nail folds, which thicken, become swollen, the eponychium disappears, and a drop of pus can be expressed (yeast paronychia). Nail plates turn dull, uneven, greyish or dark-brown (yeast onychia, Fig 33, c).

Candidiasis of the internal organs occurs in rare cases, but its course may be grave and end in sepsis.

*Treatment* The foci on the skin are treated with 1-2% alcoholic solutions of aniline dyes, nystatin or levorin ointments (200 000-500 000 units per gram of vehicle), sulphur tar ointments, Castellani's paint, 0.5-1% decamine ointment, or nitrofurylene ointment. Affected mucosa should be treated with 10-20% solutions of borax in glycerol, 1-2% aqueous and alcoholic solutions of aniline dyes (pyoktanin,

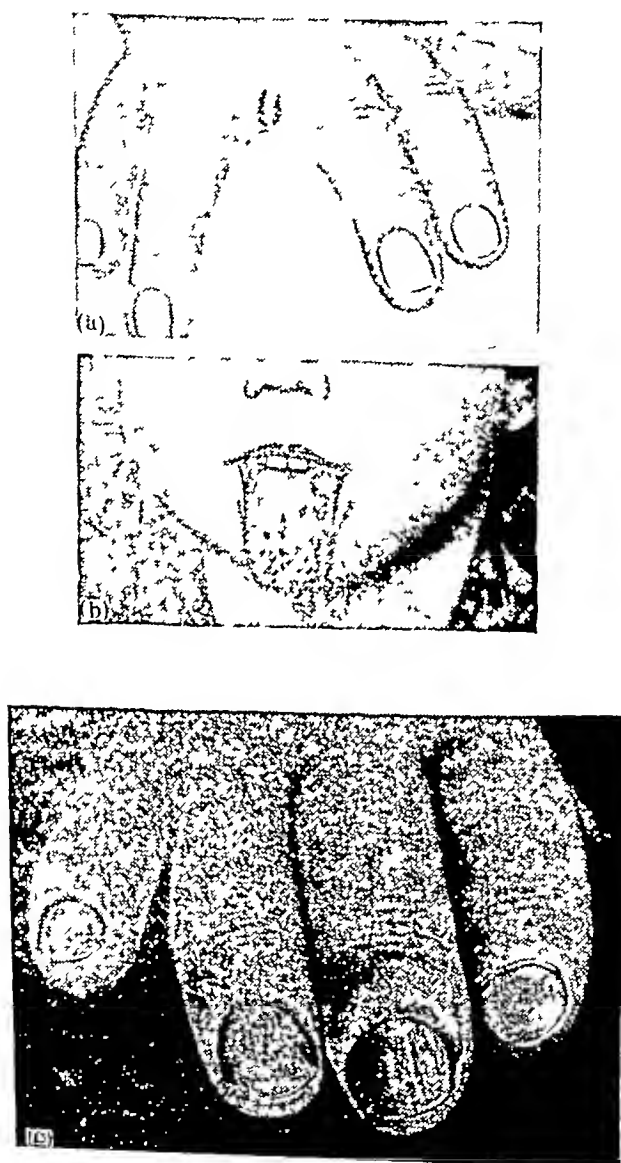


Fig 33 Candidiasis (a) of skin between fingers, (b) mucosa, (c) nails

methyl violet, gentian violet), decamine ointment (concentration from 0.5 to 5%) Nystatin or levorin (1 000 000 units 4-8 times a day), tabletted decamine or levorin in the

form of lollipops (0.15 g), two tablets 3-4 times a day, and also vitamins of group B, vitamin A concentrate, ascorbic acid and rutin should be given in diffuse processes

The general tonic therapy strengthening the patient should be carried out in candidiasis. The accompanying diseases should be treated as well. The diet of the patient should be rich in proteins and vitamins, and deficient in carbohydrates. Antibiotics and corticosteroids should be given to candidiasis patients only for vital indications

### Mycoses Control in the USSR

Mycoses are controlled in the USSR by a standard method recommended to all dermatovenereological hospitals. The work of all medical institutions is supervised and guided by research institutes and special chairs of medical educational institutes. Dermatologists, paediatrists, school and sanitary physicians, epidemiologists, and other medical specialists are involved in control of mycoses

Further success of prophylactic measures depends on health education at schools, children's institutions, boarding schools, etc

Medical nurses play a very important role in control of mycoses. Success of therapy depends largely on the care with which the nurse performs her duty. In addition to routine procedures, which nurses give to their patients, the nurse should also carry out prophylactic examinations of children and take part in health education among the adult population and at children's institutions

### *Review Questions*

28. Hair is affected by pityriasis versicolor. Yes or no?
29. Nail is affected by erythrasma. Yes or no?
30. Name the clinical forms of epidermophytosis of soles (1), (2), (3).
31. Hair is affected by trichophytosis, microsporia, and favus. Yes or no?
32. Name the clinical variants of trichophytosis (1), (2), (3).
33. Hairs break at about 5-8 mm from the skin level in (1) trichophytosis, (2) microsporia, (3) favus. Choose the correct answer

34 (1) Short hair stumps, (2) 'black dots', i.e. remnants of hair broken at the skin level, (3) high stumps of hairs broken at 5-8 mm height above the skin level, are taken for microscopic examination in superficial trichophytosis. Choose the correct answer

35 What type of trichophytosis requires rodent control?

#### SKIN DISEASES CAUSED BY ANIMAL PARASITES

Scabies and lice are transmitted from one man to another through direct contact or their belongings, especially clothes and bed linen

Scabies and pediculosis (infestation with lice) occur mainly during war time, famine, mass migration of people, etc. Impaired living conditions, inadequate care of the body, dirty clothes and the like favour the spreading of these diseases

All conditions are provided in the USSR for complete eradication of pediculosis and sharp decrease in the incidence of scabies

#### Scabies

Scabies is caused by the itch mite. A female is larger, sizing 0.25-0.35 mm, and resembles a turtle. The fore pedicels are provided with suckers, while two pairs of hind pedicels are setaceous (Fig. 34). After coitus the male dies, while the female bores into the epidermis where it makes burrows (cuniculi) to deposit about 50 eggs during her life span of 6-8 weeks. Mature mites grow from the eggs in four weeks. It has been calculated that the posterity of one female can in three months amount to as high as 150 000 000. Symptoms of scabies develop in 7-12 days after infection. The main symptom is intense itching that becomes even more intense by night. The flexing surfaces of the hands, the chest, abdomen, buttocks, thighs, genitalia (in men), and the mammary glands (in women) are mainly attacked. Paired and single vesicular eruptions appear. *Specific burrows* can be seen on the flexing surfaces of the wrist and between the fingers, the burrows appear as grey 2-3 mm long sinuous lines, when regarded through a lens the burrow appears as

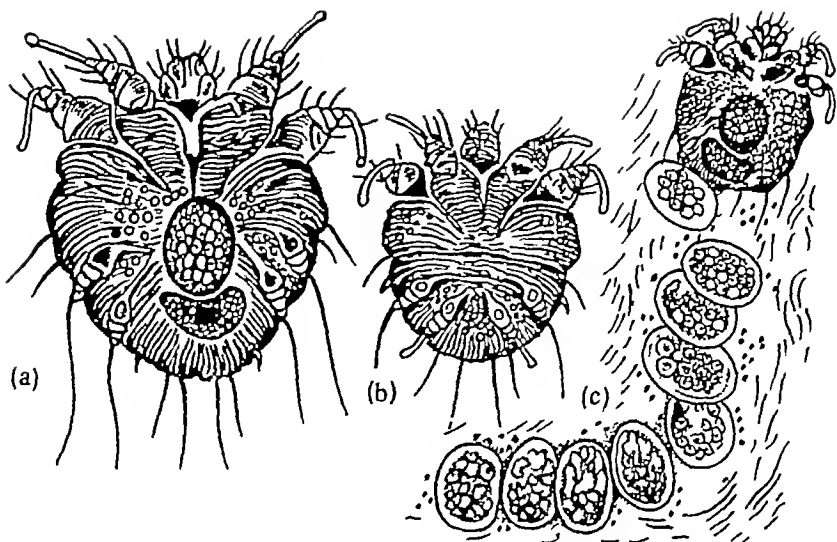


Fig 34 Itch mite

*a*—female, *b*—male, *c*—burrow (cuniculus) with a mite, eggs, and excrements

a multitude of black dots which are actually openings through which young mites emerge on the surface and through which air is admitted into the burrows. The vesicles turn into bloody crusts, the size of a pin head. Because of itching the patient scratches the skin. Hence complications pyoderma, dermatitis, lymphadenitis.

**Microscopic diagnosis.** The female mite resides at the blind end of the burrow over which a small vesicle is formed. To obtain a mite, a scalpel or a needle point is pierced under the vesicle base and moved toward the burrow. The point is then slightly raised and pulled back. Even a naked eye can see a whitish dot, the mite, at the tool point. The entire burrow and the vesicle may be cut off using a blade. The burrow can be stained by iodine tincture for the purpose of convenience.

The mite is transferred onto an object glass and a drop of isotonic sodium chloride or alkali solution is placed over it and the mite in the liquid is covered with another glass. The isotonic solution does not kill the mite. Microscopy with a small enlargement is sufficient to identify the mite.



*Treatment* Substances softening and loosening the horny layer and killing the mites are used to treat scabies. Benzyl benzoate emulsion, sulphur ointments, and the Demianovich method are used for the purpose. The benzyl benzoate therapy consists in the following: the patient takes a bath and a water-soap emulsion of benzyl benzoate (20-25%) is rubbed into the affected skin during 12 minutes using a cotton wool pad. The skin is then allowed to dry for ten minutes and the emulsion is rubbed for another 12 minutes. The patient should now change his underwear without washing the body. On the second day the procedure should be repeated (without changing the underwear). The third day is given to rest. On the 4th day the patient should take a shower, change the underwear, and all belongings of the patient should be disinfected. Before beginning treatment with benzyl benzoate the patient should take a bath.

Wilkinson's ointment, or 33-20% sulphur ointment may be rubbed into the patient's skin (Wilkinson's ointment contains 15% sulphur, 15% tar, 10% chalk, 30% green soap and 30% vaseline). One of these ointments should be rubbed into the skin every night for 20-30 minutes during 4-6 days. On the seventh day the patient is allowed to wash the body, change the underwear, and is examined.

Two solutions are used according to the Demianovich method: 60% sodium thiosulphate solution (solution No 1) and 6% hydrochloric acid solution (solution No 2). Solution No 1 is first rubbed into the affected skin two times (5 minutes into each separate member, i.e. for 25 minutes for the entire body) and then solution No 2 is rubbed into the skin in the same manner. The patient changes his underwear and is allowed to wash in 24 hours.

The concentration of the substances used for treatment of children should be reduced: 10% sulphur ointment, Wilkinson's ointment should be mixed with zinc paste (1:1), the concentration of benzyl benzoate should be 10%, of sodium thiosulphate 40%, and of hydrochloric acid 4%.

When the incidence of scabies is high, the patients are treated at special posts known as scabiosary.

*Prophylaxis* Effective treatment of patients with scabies, thorough examination of the whole family and other persons

who had contacts with the patient are prerequisite conditions for prophylaxis of scabies. Thorough disinfection (washing with special soap) of all underwear and linen of the patient or disinfection in a dry or moist hot chamber is required as well. The articles of clothes can also be washed with boiling and subsequent ironing. The outer garments should be treated in a hot chamber.

### Pediculosis

Now that the living conditions have significantly improved, pediculosis is a very rare phenomenon in the Soviet Union.

Three types of lice can parasitize on man. These are head, body, and pubic lice (Fig. 35).

**Head louse (*Pediculus capitis*)** It infests man and is transmitted from one person to another through direct contact or caps, hats, kerchieves, combs, etc. During her life a female louse deposits to 150 eggs which she attaches to hairs. Young lice appear from the eggs in 5-6 days and in three weeks they give posterity themselves. The lice can also infest the eyebrows, moustache, and the beard. The skin is scratched because of intense itching, hence pyoderma.

**Treatment** Kerosine mixed with vegetable oil (1:1) is applied to the hair, the head is covered with a kerchief and kept so overnight. The head is washed with soap in the morning and combed with vinegar (with dipping the teeth of the comb into warmed up vinegar). A 10% water-soap emulsion of benzyl benzoate can be used to treat the hair for 10-15 minutes with subsequent washing with hot water and soap.

**Body louse (*Pediculus corporis*)**, known also as clothes louse, lives in the folds of clothes but sucks human blood. It deposits its eggs in the folds of clothes and also on long hair and lanugo. Persistent cyanotic-brown pigmentation remains on the skin of the neck, shoulder blades, and in the interscapular and lumbar regions, the favourite places of lice residence.

**Treatment** consists in thorough washing of clothes with soap, disinfection of underwear and outer garments as well as linen.

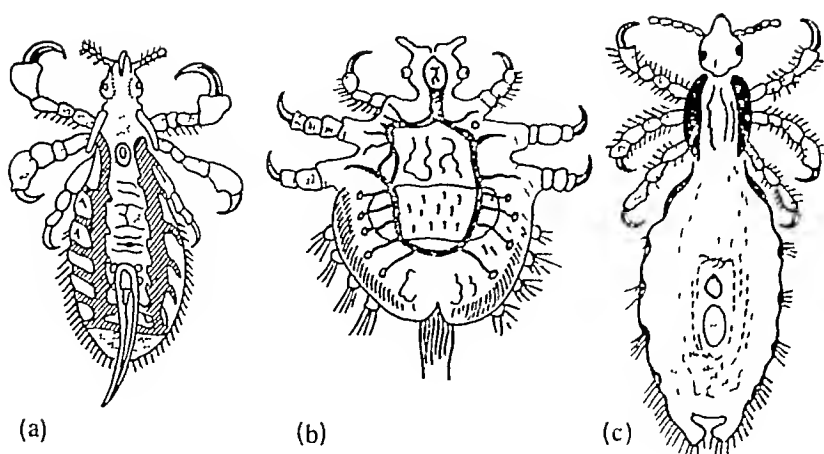


Fig 35 Lice

*a*—head louse, *b*—crab louse, *c*—body louse

**Pubic, or crab louse (*Phthirus pubis*)** lives in the hair of the pubis, sexual organs, the abdomen, around the anus, but can also spread over other haired parts of the skin. Patients complain of intense itching. The sites upon which crab lice feed are often marked by round (the size of a pea) pale-blue to pale-grey spots. The infection usually occurs during sexual intercourse.

**Treatment** Hair should preferably be shaved and the affected sites washed with hot water and soap. Diluted mercurial (blue) ointment or 10% white precipitate ointment should be rubbed into the skin for 2 or 3 days. Mercury chloride in acetic acid can also be used for the purpose.

**Prophylaxis** Regular examinations at hostels, schools, kindergartens, and other children's institutions, and also observation of rules of individual hygiene are effective means of prophylaxis of pediculosis.

### Review Questions

- 36 Name the diseases that are caused by animal parasites (1), (2)
- 37 Scabies patients have vesicles on the skin. Yes or no?
- 38 Name the methods of treatment of scabies (1), (2), (3)
- 39 What kinds of lice do you know? (1), (2), (3)

## TUBERCULOSIS OF THE SKIN

Tuberculosis of the skin is the manifestation of an active or latent tuberculous process in the body. It develops when *Mycobacterium tuberculosis* gets on the skin from other organs and tissues affected by tuberculosis (mainly tuberculosis of the lungs, lymph nodes, and bones). This way is known as metastatic or endogenic. Tuberculosis mycobacteria may get on the skin through lymph fissures and vessels, together with the blood flow, and may migrate from the main focus to the adjacent tissues.

The urine, sputum, faeces and other excretions of a patient with an active tuberculosis of the internal organs contain large quantities of mycobacteria, which get on the skin and mucosa to cause their tuberculous affection (this is known as self-infection or autoinoculation).

Cases with primary tuberculosis of the skin are much less frequent (in slaughter-house workers or workers of meat-processing plants, tuberculosis of skin develops as a result of occasional infection of the skin through minor injuries).

The penetration of *Mycobacterium tuberculosis* into the skin does not always cause tuberculosis, this depends on the status of the body, and an asthenic person (acute infection, alcoholism, etc.) will get easier affected by tuberculosis.

Clinical forms of cutaneous tuberculosis are quite varied. Lupus tuberculosus (*lupus vulgaris*) is a most frequently occurring form of tuberculosis of the skin (about 75% of all cases with cutaneous tuberculosis). As a rule, lupus tuberculosus develops in children aged from 5 to 15. The face and especially the nose would be affected. The main morphological lesion is a nodule, called lupoma. First this is only a small cyanotic-red flat tubercle, with a yellowing tint, the size of a pin head, and having distinct margins. The lupoma increases gradually in size and its surface becomes sometimes covered with scales. It is soft to palpation. When pressed by an object glass, the lupoma changes its colour to yellowish-brown, it becomes semi-transparent and resembles an apple jam. A bulbed probe will easily be indented into a lupoma under a slight pressure, when a strong pressure is applied, blood appears and the patient complains



Fig 36 Mutilation  
of the hand  
in lupus



Fig 37 Scrofuloderma (tu-  
berculosis colliquativa)

of pain These are the main three signs of a tuberculous lupoma

The nodules increase in size to fuse into infiltrative patches They later necrotize and resolve without opening to leave cicatricial atrophy, or they may form ulcers also leaving scars on healing Resolution without ulceration is characteristic of lupus tuberculosus planus during which the inflammatory phenomena are insignificant, the cicatrices are soft and the skin resembles parchment, which is easily pleated Tuberculous nodules may develop again on the cicatrices (characteristic sign of lupus tuberculosus) This form can persist for years if not treated In addition to lupus planus, some other 'dry' forms of lupus tuberculosus are differentiated: lupus hypertrophicus, lupus tumidus, and lupus verrucosus

The patches may ulcerate to transform into ulcerous forms of lupus tuberculosus which are marked by considerable inflammation surface ulcers are of irregular shape, they bleed, often fuse, and heal very slowly to leave smooth superficial cicatrices, upon which new nodules develop If the muscles, bones, and cartilages are involved, the disease becomes quite destructive (mutilating form, Fig 36) Lupus tuberculosus often disfigures the face. the mouth is

narrowed, the eyelids are affected by ectropion, the nose assumes the shape of a beak

The disease is persistent. Because of affection and distortion of the face, the psyche of the patient becomes affected as well.

**Scrofuloderma** (*tuberculosis cutis colliquativa*) This is a frequently occurring form of skin tuberculosis, essentially of early life. As a rule, this is a secondary disease, which arises as an expansion of tuberculous affection of bones and joints, less frequently this is a primary syndrome arising due to the transport of tuberculosis mycobacteria by blood or lymph from the foci in the lungs or other organs. The common location of scrofuloderma is the neck, under the mandible, the chest, sub- and supraclavicular regions. A dense painless node (the size of a walnut) first develops in the subcutaneous connective tissue. The node increases in size gradually and fuses with the skin which becomes cyanotic-red. The node then softens in the centre and opens to form a fistula (or fistulas, Fig 37) through which thick pus is discharged. Scrofuloderma ulcers are not painful, they have fistulous passages that may be detected by probing. The bottom of the ulcer is irregular, coated with purulent-necrotic exudate, the bottom of the ulcer is bleeding while the margins are soft and slightly separated. The ulcer heals to leave irregular scars with papillae, 'bridges' and protrusions of intricate shapes.

Other forms of cutaneous tuberculosis occur less frequently, these are papulonecrotic, ulcerous tuberculosis of the mucosa and the skin, etc.

**Treatment** Specific preparations (streptomycin, phthivazid, PASA, etc.) are given along with general strengthening therapy (cod-liver oil, ascorbic acid, vitamin B complex, preparations of iron and phosphorus). Reasonable regimen is also important (alternation of work and rest, daily walks, exercises, adequate sleep and food rich in proteins, fats, vitamins, and deficient in carbohydrates and salt).

Streptomycin and dihydrostreptomycin are given intramuscularly once a day (0.5-1 g). The total dose for a course of treatment is 40-80 g (40 000 000-80 000 000 units) in all forms of tuberculosis, especially in lupus tuberculosis with concurrent tuberculosis of the lungs. These prepara-

tions may however cause side effects, some of which may be grave (deafness)

Phthivazid, saluzid, isoniazid (tubazid) should be given per os, 1-2 g daily in 3-4 intakes, the total course—150-200 g in all forms of lupus tuberculosis, scrofuloderma and other forms of cutaneous tuberculosis

Vitamin D<sub>2</sub> should be given in an alcoholic solution or as an oil suspension, 50 000-100 000 units daily per os for several months in lupus tuberculosis and scrofuloderma

Vitamin D<sub>2</sub> should be given together with streptomycin and PASA. A daily dose of PASA is 8-12 g (4 intakes, 30 minutes after meals). The total dose per course, 800-1 000 g. PASA is prescribed mainly to patients with scrofuloderma

Two or three anti-tuberculosis preparations are usually given. Repeated courses are prescribed. Health resorts and sun baths are helpful to patients with skin tuberculosis in the absence of affection of other organs

Diathermocoagulation, surgical incision of the foci, and curettage are recommended in some cases

Control of cutaneous tuberculosis in the USSR is effected through the agency of special dermatological posts of anti-tuberculosis institutions which are responsible for treatment and surveillance of dermatological patients, inspection of their families, and improvement of their living conditions

Great advances have been achieved in the USSR in tuberculosis control in general and in control of tuberculous affections of the skin in particular

### *Review Questions*

40 Lupus tuberculosis occurs mainly in persons aged (1) from 5 to 15, (2) from 15 to 30, (3) from 30 to 50, (4) over 50. Choose the correct answer

41 Lupoma has a firm consistency. yes or no?

42 When a bulbed probe is indented into a lupoma the patient feels a sharp pain. yes or no?

43 A scrofuloderma opens to discharge pus. yes or no?

44 What is the total dose of streptomycin per course of therapy in tuberculosis of the skin?

45 What is the course dose of phthivazid, saluzid, tubazid?

## LEPROSY

Leprosy (lepra) is a grave chronic disease caused by the microorganism *Mycobacterium leprae*, which resembles *mycobacterium tuberculosis* in appearance

First signs of the disease develop only in 4-6, and even as late as in 10-20 years after infection. The causative agent penetrates the human body through the nasal mucosa, the upper airways or skin during prolonged and intimate (familial) contact with the leper. Poor hygiene and poverty favour the development of the disease. Infection usually occurs in early life. The skin, and mucosa, the nervous system and the internal organs are attacked by this disease.

Two main variants of leprosy are differentiated: lepromatous or malignant and tuberculoid leprosy. There is a further division into subgroups: indeterminate or non-specific type and dimorphous or mixed type.

Lepromatous leprosy is characterized by the development of violet (with cherry-red tint) maculae, tubercles and nodules (lepromas), and also reddish-brown diffuse infiltrates. The face is affected in the majority of cases which becomes like a muzzle of a lion (Fig. 38). Lepromas may ulcerate or resolve. The mucosa of the nose, mouth, larynx, and also bones, liver, eyes, and lymph nodes are often affected. Mutilation of the hands and feet (due to resolution of the bones) develops. Sensitivity in the region of maculae is lowered (or lost altogether) at later terms in this form of leprosy. Patients with lepromatous leprosy present great danger to the surrounding people because leprosy bacillae are contained in great quantity in the nasal mucus and the exudate of the ulcers.

Tuberculoid leprosy is characterized by the formation of



Fig. 38. Lepromatous leprosy



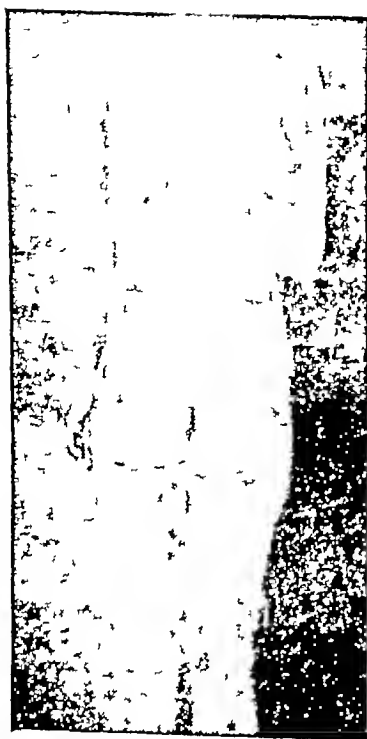


Fig 39 Disseminated tubercu-  
loid lepra

maculae, nodules, and (less frequently) tubercles with decreased tactile, pain, and temperature sensitivity on their surface (Fig 39) These heal without ulceration, leaving depigmented spots and sometimes atrophy Thickening of some nerve trunks is characteristic, paresis and paralysis occur Contagiosity of these patients is not great since leprosy bacillae are rarely found in the nose mucus

The indeterminate type of leprosy is characterized by the absence of typical lesions Discoloured and pigmented spots with lost sensitivity are found on the skin along with a small number of indistinct spots Polyneuritis, thickening and degeneration of the nervous trunks occur, which are associated with development of ulcers, muscular at-

rophy, disfiguring joints, paralysis, and loss of sensitivity over large areas of the skin

The dimorphous or mixed type of leprosy is characterized by the presence of simultaneous changes specific for the previous three types of leprosy Nasal mucus, scarificate or punctate of leprosy tubercles, lymph nodes, scarificate or emulgate of leprosy maculae, punctate of the nerve trunks, and smears and imprints of biopsied slices, etc, are used in tests for leprosy

Nasal mucus is taken on a cotton wool tampon wound round a forceps or a thick wooden stick The mucosa of the nose (especially its septum) should be rubbed quite energetically for 30-40 seconds till possible bleeding An object glass is then rubbed energetically several times with this tampon

Leprous tubercles and lymph nodes are punctured by a syringe with a well-lapped needle and piston. Smears are prepared from the punctate (like blood smears).

Leprous maculae are scarified by a scalpel until fluid appears from the tissue and smears are then prepared.

A smear-print is prepared as follows: the inner side of a biopsied tubercle, papule or the like is rubbed against a glass slide, the smear is dried up and stained.

Effectiveness of *treatment* of leprosy depends on the time when the treatment begins. Sulphone drugs (DDS, solusulphon, sulphatine or sulphone), chaulmoogra preparations (chaulmoogra oil), thiourea derivatives (Siba-1906, ethoxide), ethionamide, etc., are used to treat leprosy.

**Leprosy control in the USSR.** Patients with active leprosy are treated at leprosary, where adequate nutrition and proper regimen are provided for the patients. The family of the patient are observed for a long period of time.

Leprosy incidence has markedly decreased in the USSR mainly due to effective means of its control.

### *Review Questions*

46 Name the main types of leprosy (1), (2)

47 Name clinical subgroups of leprosy (1), (2)

## LUPUS ERYTHEMATOSUS

The aetiology of lupus erythematosus is unknown. Endocrine disorders, dysfunction of the connective tissue, hypersensitivity of patients to ultra-violet radiation, and foci of chronic infection all may contribute to the onset of the disease.

Lupus erythematosus is a chronic disease, which usually localizes on the face. Round or oblong red maculae appear on the skin and develop into infiltrative foci covered with scales. The process ends in atrophy of the skin (Fig. 40). The foci often form a pattern resembling a butterfly (Fig. 41). Cicatricial atrophy of the haired skin of the head causes stable loss of hair. The red border of the lower lip bears a ridge of dense horny scales (on livid spots) and sites marked by cicatricial atrophy.

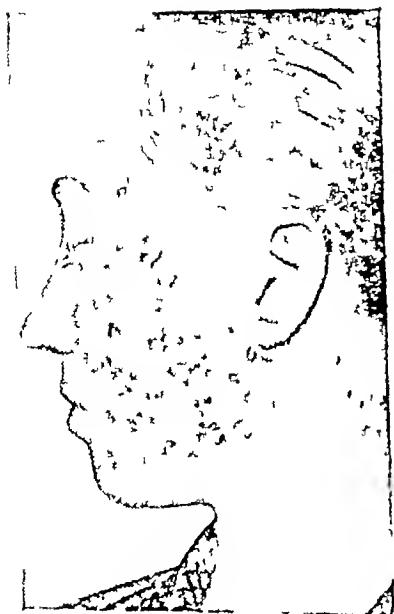


Fig 40 Atrophy of the skin  
in lupus erythematosus

Fig 41 Lupus erythematosus

*Systemic lupus erythematosus* (acute and subacute) occurs in rare cases. The kidneys, liver, heart, and joints are affected by the disease, which is very grave and often fatal.

**Treatment** Chronic lupus erythematosus is treated with chingamine (delagil, resochin), 0.25 g tablets two times a day for a total of 40 days (20 g or 80 tablets per course of therapy). Quinacrine is given in 0.1 g tablets, three times a day during ten days. The course comprises 5-6 such cycles which follow at 5-10 day intervals. Nicotinic acid is given in 0.1 g tablets twice a day after meals or intravenously in the form of a 1% solution (from 2 to 10 ml in a total of 10-15 injections). Vitamin B<sub>12</sub> is helpful to some patients, it is given daily or every other day in a dose of 100-200 µg per day (20 injections for a course). Biochinol is also given 2 ml, twice a week, the total dose being 40 ml. Externally used is a 10% quinacrine plaster or 10% quinacrine ointment, sinalar ointment, treatment with carbon dioxide snow is also effective. To prevent relapses of the disease, oint-

ments containing 5-10% quinine or salol (phenyl salicylate) are used which protect the skin from sun rays. Soviet-made emulsion 'Luch' is also used for the purpose. Corticosteroids are given to patients with subacute and acute lupus erythematosus.

### Review Questions

48 Can lupus erythematosus be attended with (1) infiltrative foci, (2) bullae (3) wheals, (4) scales, (5) atrophy of the skin?

49 Are corticosteroids used to treat subacute and acute lupus erythematosus? Yes or no

## DERMATITIS AND TOXICODERMA

Dermatitis is an acute inflammation of the skin resulting from external irritating stimuli, which are divided into *unconditioned* (stimuli universally causing dermatitis in all people, such as strong acids and alkalis, water at a temperature above 50°C, etc.) and *conditioned* or *allergic* stimuli (those causing dermatitis only in some people who are hypersensitive to them).

Dermatitides resulting from unconditioned stimuli are simple or artificial dermatitides, and those caused by allergens are called allergic dermatitides.

Toxicoderma is an acute inflammation of the skin resulting from inhaled or ingested stimulant, or from that administered intravenously, subcutaneously or intramuscularly.

Dermatitis simplex arises as an acute response to certain stimuli and is characterized by bright redness and oedema of the skin. Depending on the strength of the irritating effect, the skin may develop vesicles, bullae, or necrosis. Patients feel fever, burning, pain and itching. If the stimulus is removed, dermatitis subsides in one or two hours without leaving any trace. If tissues are necrotized, ulcers are formed which heal to leave cicatrices.

Allergic dermatitis arises in persons with hypersensitivity to certain allergens (chemicals, such as salts of chromium, nickel, resins, pollen of some flowers, plants, etc.). Hypersensitivity may be congenital (idiosyncrasy, e.g. to eggs, strawberry, etc.), but in most cases allergy develops grad-



Fig 42 Erythema caused by sulphha drugs

usually on a repeated exposure to the allergen (sensitization) Redness, oedema, nodules, vesicles and bullae develop on the skin When the action of the allergen is removed, the inflammation subsides, but relapses on repeated exposure to the irritant Allergic dermatitis may develop into eczema on prolonged and repeated exposure to the allergen

In toxicoderma the eruptions are located in symmetrical patterns The general condition of the patient is often grave and the process is more intense than in allergic dermatitis Disseminated pink-red or cyanotic-red macular eruptions appear on the skin

of these patients, vesicles, bullae, and wheals may develop as well

Medicamentous dermatitides are also known These may be simple (due to the action on the skin of salicylic acid and potassium permanganate both of high concentrations, etc ) and allergic (in medical personnel exposed to streptomycin, aminazine, etc ) However toxicoderma would usually result from administration of medicinal preparations per os, subcutaneously, intravenously or intramuscularly Medicamentous dermatitis may be caused by reception of one particular medicinal preparation and always develops on one and the same site Medicamentous dermatitis would usually be caused by penicillin, streptomycin, streptocide, sulphadimezine, less frequently by amidopyrine, quinacrine, procaine, iodine, bromine, mercury and other preparations (Fig 42)

*Treatment* Removal of the stimuli or allergens will as a rule promptly remove dermatitis without leaving any trace Neutral lotions, pastes, shake lotions and ointments

are prescribed externally in simple dermatitis. Patients with allergic dermatitis and toxicoderma are given desensitizing therapy and antihistaminic preparations (see page 35). To excrete the allergen from the body, purgatives, diuretics, and much liquid are prescribed.

## ECZEMA

Eczema is an acute or chronic allergic disease of the skin characterized by polymorphism of lesions, persistent course, frequent relapses, and intense itching. Eczema is one of the most frequently occurring skin diseases (10-15%). Various disturbances in the function of the central nervous system play an important role in the genesis of eczema. Eczema patients are hypersensitive to many allergens (as distinct from patients with allergic dermatitis, who are sensitive to one allergen). Among the numerous allergens there may be external ones, such as chemicals, sun radiation, water, soap, various plants, foods, medicinal preparations, and also intrinsic allergens, e.g. diseases of the liver, gastrointestinal tract, helminthiasis, chronic focal infection, endocrine disorders, etc. And all these endogenic and exogenic factors may cause allergic response in one patient. Microbial toxins, fungal metabolites, and other factors can cause allergic states in the body. Pathogenesis of eczema is thus complicated. The most frequent location of the eczematous lesions is the face and the extremities.

**Acute eczema.** The skin first becomes red and oedematous. Nodules and vesicles having the size of a pin head and filled with clear fluid develop later. The vesicles rupture to form pointed erosions with watery discharge. Eroded sites fuse into larger ones to form weeping surfaces (Fig. 43). When weeping lessens, crusts and scales are formed. New nodules, vesicles, and weeping lesions may develop. If pyogenic infection joins, pus and yellow crusts are formed. Acute and chronic eczema is characterized by polymorphism of lesions (erythema, nodules, vesicles, crusts, scales) and also by symmetry in the arrangement of the lesions, indistinct margins of the foci, intense itching and burning.

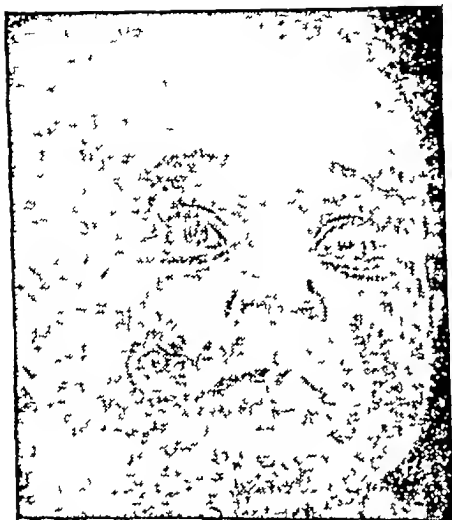


Fig 43 Acute eczema



Fig 44 Microbial eczema

The disease subsides in a few weeks and then recurs again. Acute eczema often turns into a chronic disease. In chronic eczema the skin thickens, becomes firm, and the lesions become more vivid. Cyanotic-red foci are covered with crusts and scales and are strongly itching. The disease exacerbates periodically (chronic exacerbated eczema). It may continue for years and decades.

Eczema has several variants. *Microbial eczema* is characterized by location round infected wounds, ulcers, or pustules. The lesions have distinct boundaries and are located in asymmetrical patterns, mainly on the legs (Fig 44). In *seborrhoeal eczema*, the haired part of the head, the face, the chest, the area between the scapulae, and skin folds (armpits, behind the ear helix), i. e. sites rich in sebaceous glands, are mainly affected. The foci of seborrhoeal eczema are yellow-red, coated with fatty yellowish crusts. Itching is less intense than in other forms of eczema. *Infantile eczema* is characterized by reddening of the skin with subsequent vesiculation, weeping, and formation of crusts on the haired skin of the head, the face, the buttocks, less frequently on

the other parts of the trunk and extremities (Fig 45) Itching is severe Infants with eczema have deranged sleep and appetite, they become restless and cry Infantile eczema is usually due to improper or excess feeding, intolerance of some food (cow milk, proteins, berries, citrus fruits, etc) and in gastrointestinal dysfunction (constipation, regurgitation)

*Treatment* The patient should be examined thoroughly and all concurrent diseases (if any) should be treated Maximum should be done to remove the factors responsible for hypersensitivity of the body

Sedative drugs acting on the nervous system and desensitizing the body should be given for the *general* treatment Antihistaminic preparations and vitamins are given Corticosteroids are prescribed in grave forms of eczema (see 'Basic Principles of Treating Patients with Skin Diseases')

*External* treatment should depend on the degree of the inflammation (severity of the process), location of the foci, and their dissemination Cooling lotions and aqueous shake lotions should be applied in acute eczema When inflammation subsides, or if the disease becomes chronic, concentration of oil shake lotions, pastes or ointments should be gradually increased Corticosteroid ointments are often prescribed

### Review Questions

- 50 Itching is characteristic of eczema yes or no?
- 51 Monomorphism of lesions is characteristic of eczema yes or no?
- 52 Acute eczema usually localizes on (1) the face, (2) the trunk, (3) the extremities Choose the correct answer
- 53 Lotions and aqueous shake lotions are used in acute eczema yes or no?



Fig 45 Weeping eczema in a child



## OCCUPATIONAL DISEASES OF THE SKIN

Certain industrial factors may cause occupational skin diseases. Among the *signs of occupational diseases* are corns in workers engaged in heavy physical labour, non-inflammatory spots due to deposited coal (in miners, firemen), carbon black, and also scars from burns with metal, etc.

Sanitary conditions of labour, general status of the worker, and the properties of the harmful substances are important for the development of occupational diseases of the skin.

Many substances may become factors of industrial hazard: high and low ambient temperature, high humidity of the air, dust, solid particles, acids, alkalis, plastics, medicinal preparations, etc.

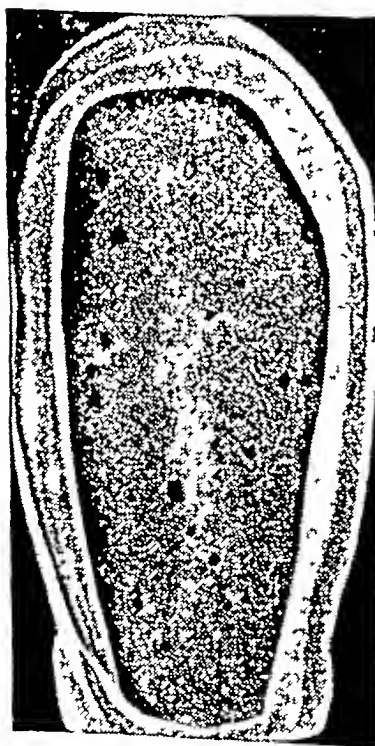


Fig 46 Occupational folliculitis (chronic exposure to oils)

Simple and allergic dermatitis, occupational eczema, pyodermitis arise from exposure to industrial hazards. For example, folliculitis, or sebaceous acne (Fig 46) occur in persons exposed to lubricants.

**Treatment** The cause of the disease should in the first instance be revealed and removed. The patients should be given general and external treatment, following the same principles as in treatment of like diseases of non-occupational aetiology.

**Prophylaxis** This consists in strengthening of the general status of the body (hardening, exercises, etc.), removal or at least lessening of the harmful industrial factors (through automation of processes, etc.), protection of the skin from contact with harmful substances (wearing over-

alls and gloves, using protective films and ointments) Medical workers should supervise sanitary measures in industry, observation of rules of individual hygiene by workers, regular taking shower at the end of the working shift, treatment of minor injuries by a 2% iodine tincture, 1-2% alcohol solution of aniline dyes Health education among industrial workers is also effective

### ITCHING DISEASES OF THE SKIN

This group comprises diseases in which itching is one of the main symptoms or the main symptom These are neurodermitis, pruritus, nettle rash, prurigo of children and adults

**Neurodermitis.** Factors responsible for the onset of neurodermitis are the same as of eczema (nervous disorders, endocrine dysfunction, disturbances in the internal organs). *Localized neurodermitis* commonly occurs (Fig 47) Intense itching develops on the back of the neck, in the elbows, popliteal fossa, less frequently on other parts of the body. Itching is followed by the appearance of flat reddish nodules, which fuse to form patches of thickened skin with a rough pattern (lichenization) The patient scratches his skin to form lesions and crusts

Diffuse neurodermitis begins with persistent itching of the entire skin The skin becomes dry, pigmented, thick, and covered with bloody crusts This is a lengthy disease

**Treatment** The accompanying diseases should be treated, special attention being given to the treatment of the nervous system (sleep therapy, hypnosis, bromine preparations, procaine) Corticosteroids are given per os and as ointments Health resort therapy is also indicated Externally are used pastes and ointments containing 2-10% tar, ASD preparation (10-20%), radiotherapy (of circumscribed indurated foci), and also paraffin

**Pruritus** The only sign of this disease is persistent itching *Localized* (mainly in the anal and genital regions) and *total* skin itching (almost all skin is affected) are differentiated The causes of the disease are nervous strain or shocks, chronic intoxication (helminthiasis), upset metabolism (senile pruritus).

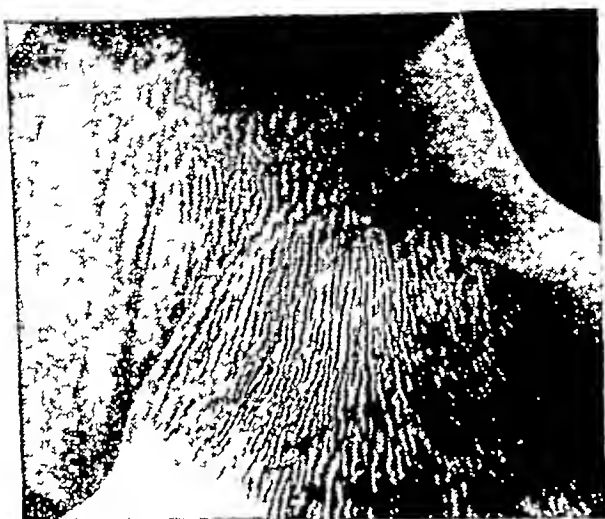


Fig 47 Localized neurodermitis

*Treatment* The cause of itching should be removed by antihistaminic preparations, alcoholic solutions of menthol, anaesthesine, carbolic acid, and dimedrol

**Nettle rash (urticaria).** This is an allergic disease characterized by the appearance of slightly elevated patches and intense itching. Many external and internal factors may cause nettle rash: eggs, shellfish, strawberries, penicillin, sera, quinine, and other drugs, gastrointestinal diseases, diseases of the liver, kidneys, helminthiasis, bites of bedbugs, mosquitoes, stinging nettle, primrose, warmth and cold. Acute attacks of nettle rash may be provoked by nervous and psychic stress. Wheals (Fig 48) may be red, pink, or white in colour. These are oedematous formations resembling the traces left by stinging nettle; their appearance is attended with severe itching and burning. *Acute*, lasting for a few days, and *chronic* nettle rash, lasting for months and years, are distinguished.

*Treatment* Purgative, desensitizing and antihistaminic preparations are prescribed. If the cause of chronic nettle rash is revealed, it should be removed. External sedatives are given to soothe itching.

**Infantile prurigo (strophulus)** The disease attacks the infant

during its first or second year of life. The causes of the disease are intestinal dysfunction associated with helminthiasis and over-feeding, intolerance of sweets, eggs, sometimes cow milk, hypersensitivity to bites of bed-bugs, mosquitoes, etc. Wheals crowned with small (the size of a millet grain) and firm nodules are formed on the skin of a child to cause severe itching. The nodules are often topped by a small vesicle. The wheals soon disappear, while the nodules persist for 2-3 weeks. Intense itching deranges sleep and makes the infant restless. Pyoderma is likely to occur.

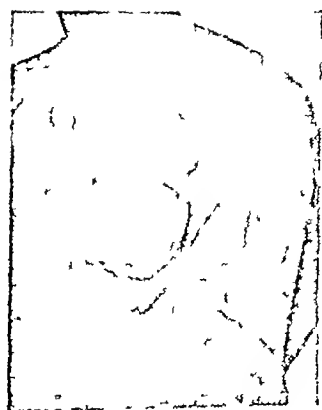


Fig 48 Nettle rash  
Response to mechanical  
stimuli

*Treatment* includes the removal of the cause of the disease and soothing and antihistaminic preparations. Alcoholic solutions, creams and ointments, containing corticosteroids, are given to soothe itching.

**Prurigo of adults.** The disease often begins in childhood as strophulus but when the child grows to 3-4 years of age, the clinical picture of the disease becomes characteristic of prurigo of adults. Numerous nodules appear on the flexing surfaces of the extremities, many of them being covered with bloody crusts. The nodules cause severe itching and the patient would scratch the skin to bleeding. Hence the crusts and scars. The skin is pigmented, lichenized, the lymph nodes enlarge.

Prurigo mainly occurs in children of low-paid parents living in conditions of poor hygiene. During the sexual maturation period prurigo is often healed spontaneously. The incidence of this disease in the Soviet Union is low.

*Treatment* Improved living conditions, adequate sleep, and sufficient fresh air usually help. Dairy products, fruits, vegetables and vitamins are effective too. Preparations containing iron and phosphorus are recommended. Soothing preparations should be applied externally.

*Review Questions*

54 Name the clinical forms of itching skin diseases (1), (2), (3), (4), (5)

55 Antihistaminic preparations are used to treat patients with itching yes or no?

56 Does the nervous system require any treatment?

## PSORIASIS

Psoriasis is a rather frequently occurring disease (2-3% of all patients with skin diseases)

Aetiology of psoriasis is unknown. There exist nervous, viral, endocrine and other theories which try to explain the disease. Psoriatic lesions are monomorphous. The disease is characterized by the appearance of flat, cyanotic-red papules of regular rounded shapes, varying in size, and covered with silvery-white scales. The foci tend to grow peripherally and fuse. When scales are scraped off, the surface of the papule resembles stearine. Further scraping reveals psoriatic film. If the film is removed, minute droplets of blood appear on the red surface of the papule (punctate haemorrhage). These are symptoms specific for psoriatic papule. When fused together, papules form patches covered with silvery scales (Fig 49). Psoriatic lesions may occur on any part of the skin, but the flexing sides of the extremities and the haired skin of the head are usually attacked by the disease. Psoriasis may attack the joints and the nails. *Progressive stage* of psoriasis (marked by a multitude of fresh papules with a red circle round them, and in some cases itching), a *stationary stage* (new lesions stop developing, itching is often absent), and a *regressive stage* (the papules and patches begin resolving, Fig 50) are differentiated. Psoriasis may persist for decades.

*Treatment* General and local treatment depends on the stage of the disease. Treatment of the progressive stage should be very careful. Preparations of calcium, vitamins B<sub>1</sub> and B<sub>12</sub>, sodium thiosulphate, and other desensitizing preparations are given. External neutral preparations are also prescribed. In grave cases (generalized process, arthropathy, erythroderma) use is made of corticosteroids, methotrexate and other cytostatic preparations. When the lipid



Fig 49 Psoriasis



Fig 50 Psoriatic patches (resolution)

metabolism is upset, 0.25-0.5 g methionine is given 3-4 times a day, 0.025-0.05 g of vitamin B<sub>12</sub> three times a day, 0.3 g of vitamin B<sub>15</sub>. Tonsillectomy or irradiation with a narrow beam of a quartz lamp is indicated. Injections of gamma globulin should be given to children.

The stationary or regressive forms of psoriasis are treated with aminopterin, 6-mercaptopurine in 0.05 g tablets (under supervision of a physician), auto-transfusion of blood, preparations of arsenic (Fowler's solution, Asiatic pills), injections of pyrogenal, prodigiosane, external preparations such as salicylic ointment (2%), ointments with tar, ichthammol, naphthalan oil, Rybakov's ointment, psoriazine, etc. Ointments containing corticosteroids (sinalar, ultralan, flucinar, etc.) are also used.

### *Review Questions*

57 Psoriatic lesions are monomorphous: yes or no?

58 Psoriasis is characterized by the presence of (1) vesicles, (2) pustules, (3) nodules, (4) papules, (5) tubercles. Choose the correct one

59 Name the stages of psoriasis (1), (2), (3)

### LICHEN PLANUS

Lichen ruber planus is a disease of the skin characterized by formation of inflammatory (not acute) papules and itching. Nervous disorders are considered by many authors to be the main cause of the disease.

The papules are flat polygonal pink-red (with a violet tint) formations varying in size from a millet grain to a lentil and over. Centres of many nodules are indented (like a navel, Fig 51). When lighted from aside the papules have a wax-like lustre. The eruption is attended with severe itching. The most favourite localization of the lesions are flexing surfaces of the forearms, elbows, armpits, popliteal fossa, and the anterior surface of the legs. The papules fuse into patches. The mucosa of the mouth is also affected in some cases (whitish papules form a kind of a network). The genitals may also be involved.

*Treatment* Nicotinic acid (per os or intravenously), procaine (intramuscularly), vitamin B<sub>1</sub> (6% solution), preparations of bromine, dimedrol, diazoline, trioxazine and diazepam (seduxen) are given in acute cases. Penicillin (200 000 units twice a day) or antibiotics with a wide effective range (tetracycline, oxytetracycline, erythromycin, oletetrin, metacyclin 100 000-200 000 units 3-4 times a day) are often effective when given for 10-14 days. Hypnotherapy and indirect suggestion are helpful as well. Ointments, pastes, solutions containing 5-10% anaesthesine, 1-2% menthol or carbolic acid, and corticosteroid ointments are applied externally. Preparations of arsenic, iron, vitamin A concentrate, vitamin B com-

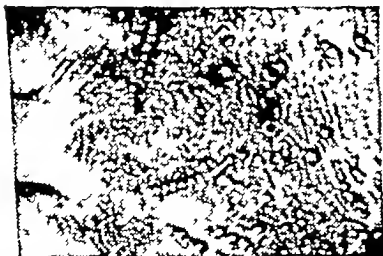


Fig 51 Lichen planus

plex, ascorbic acid, rutin, and mydocalm are given in the stationary stage of the disease. Radiotherapy is effective in infiltrative patches. Health resorts are indicated in persistent forms of the disease.

### PITYRIASIS ROSEA (GIBERT'S DISEASE)

This is a skin disease with an obscure aetiology. It is characterized by pink papulosquamous eruptions on the lateral and anterior surfaces of the chest, back, and abdomen, less frequently on the neck and shoulders (by the line of skin tension). The oblong lesions vary in size and colour (from pink to reddish, Fig. 52). Larger patches appear first (mother patch). The central part of the patch becomes yellowish, covered with small scales, and resembles crumpled paper. The patient complains of itching. The patches become paler in 2-4 weeks, itching subsides, and the patient recovers in 45-60 days. The disease occurs mostly in spring and autumn.

*Treatment* The affected sites of the skin should not be washed with water and soap. Neutral suspensions and pastes are prescribed. Calcium pantothenate (0.5 g three times a day) is given per os to stop the process.

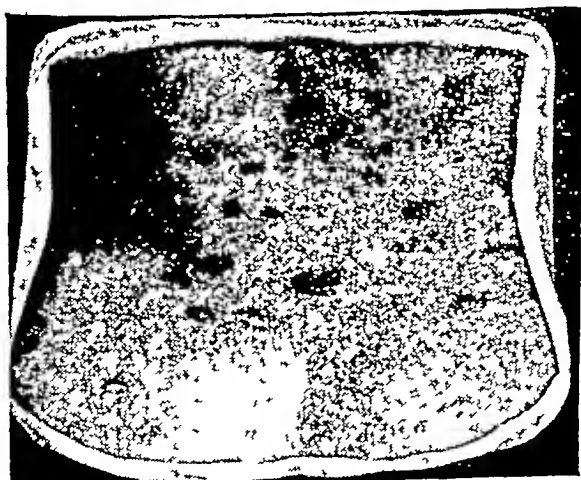


Fig. 52 Pityriasis rosea



## VESICULAR DERMATITIDES

Herpes zoster, herpes simplex, dermatitis herpetiformis (Duhring's disease) and pemphigus vulgaris are the most frequently occurring vesicular dermatitides

Herpes simplex is caused by filterable virus which is often present in the body and is at times activated by chills, intoxication, and gastrointestinal disorders

Vesicles filled with clear liquid would usually develop on the borders of the lips or nares, and the genitals. The onset of the disease is marked by the appearance of a group of watery blisters, each sizing a millet grain, on an intact or slightly hyperaemic skin or mucosa. Their appearance is attended with itching and burning. The blisters rupture in a few days to form eroded spots covered with a thin crust. Chronic recurring herpes simplex, which would usually attack the genitals and the lips, is especially annoying.

*Treatment* Foci of herpes simplex are treated by aniline dyes and boric-tar ointment. Chronic relapsing herpes simplex is sometimes treated effectively by smallpox vaccination (3-4 vaccinations by the commonly adopted technique). This method is more effective in cases where the vaccination gives a positive reaction. Gamma globulin and staphylococcal vaccine (0.2-0.3-0.5-1.0 ml, every other day, intracutaneously) are given. DDS, 0.005-0.01 g, two times a day (one or two five-day cycles with a three-day interval) is also given. Interferon lotion or paste (interferon and nutritive solution, 1:1), local baths of 0.25% potassium permanganate solution should be applied externally.

Herpes zoster is caused by a neurotropic filterable virus. The vesicles develop along the course of the nerve in groups and often form a girdle or an encircling pattern, hence the name (Greek *zoster* means a girdle). The vesicles often become purulent, painful or bleed. The general condition of the patient worsens. The disease usually attacks in spring and autumn.

*Treatment* Shower and bath are contraindicated. Healthy portions of the skin should be wiped with boric alcohol. Neutral powders are recommended in acute eruptions. Sodium salicylate, antihistaminic preparations, analgin and pyramidon (0.25 g, three times a day, in neuralgic pain)

should be given. When acute period subsides, ultra-violet radiation and auto-blood transfusion are indicated. Vitamin B<sub>1</sub> (50 mg daily), vitamin B<sub>12</sub> (400-500 µg every other day) should be injected (a total of 20 injections). Antibiotics should be given in gangrenous and generalized forms, along with external application of aniline dyes, Castellani's paint, interferon lotions.

**Dermatitis herpetiformis (Duhring's disease).** The aetiology and pathogenesis of the disease are unknown. Many authors maintain that ultravirus is the causative agent. The dermatitis usually attacks adults. The disease is marked by development of polymorphous lesions (maculae, papules, pustules, vesicles, bullae). The lesions are arranged symmetrically, often recur, and are accompanied by intense itching. The lesions appear unevenly, are grouped in garlands, arches, and circles. When healed, the lesions leave marked pigmentation on the skin.

The diagnosis is established by the clinical picture, severe itching, eosinophils in the blood and the vesicles (to 40-50%), and positive iodine tests (ointment containing 50% solution of potassium iodide is applied to the skin of the forearm for 24 hours to cause new eruptions), the same effect is observed with 5-10% potassium iodide solution taken by mouth. The disease is persistent (5-10 years, and over) and chronic. Prognosis is favourable.

**Treatment.** Large bullae are cut off by scissors, pus and horny covers are removed by sterile gauze, and talcum is applied to the erosions. Smaller vesicles are treated with Castellani's paint. Given per os are DDS (0.005 g, two times a day, for 1-2 months) and resiquine (0.25 g, three times a day for ten days and after a 5-day interval, the cycle is repeated three to five times). Sulpha preparations are indicated as well. Vitamin B<sub>15</sub> (0.05 g three times a day for 1-2 months) is given. Small doses of steroid hormones are given in grave cases, antibiotics are indicated in pustulation. **Pemphigus vulgaris** is a grave chronic disease that was invariably fatal until corticosteroid hormones have been used to the effect of remission.

The aetiology of the disease is obscure. Viral, neurogenic, metabolic and other theories try to explain the genesis of pemphigus. Bullous lesions filled with lemon-yellow clear

liquid rapidly develop on an intact and mucocutaneous surfaces. The mucosa of the mouth, nose, and pharynx is attacked first, followed by development of lesions on the skin. The bullae soon become flaccid, their contents dries to form crusts, erosions are more frequently formed after rupture of the bullae. If untreated, the eruptions continue to give new eroded surfaces which make the patient suffer pain during taking food. The patient yields an unpleasant stagnant odour. The general condition of the patient is grave.

The Nikolsky symptom is important for the diagnosis (slight detachment of the epidermis on the skin adjacent to the bullae and even remote from them). Revealing acantholytic cells (containing large nuclei) is another evidence of the disease.

*Treatment.* Before the bullae rupture spontaneously, the nurse should puncture them by a sterile needle to discharge their contents using a sterile gauze or cotton wool tampons. Sunflower seed oil dressings should be used to soften and remove crusts. Xeroformic, prednisolone, or 1% heliomycin ointments should be applied to the eroded surfaces.

The general treatment comprises corticosteroid hormones, first in big doses (60-120 mg of prednisolone, 6-10 mg of dexamethazone, 20-60 mg of triamcinolone), and then the dose should be decreased until a minimum effective dose is found that prevents development of new bullae (maintenance dose). Symptomatic therapy is very important: cardiac preparations, detoxication therapy, vitamins. In order to decrease intoxication (as in erythroderma and toxicoderma) it is useful to infuse isotonic solution of sodium chloride (the first infusion should amount to 10 ml). If arterial pressure is elevated, the infusions are contraindicated.

The food should be rich in proteins, vegetables, fruits, and vitamins.

### *Review Questions*

60 Shower or bath are not contraindicated in herpes zoster yes or no?

61 Large bullae may be opened artificially in pemphigus vulgaris and in Duhring's disease yes or no?

## DISEASES OF THE CUTANEOUS GLANDS

Seborrhoea is a functional disorder of the sebaceous glands marked by increased or decreased excretion from these glands and changed physical properties and composition of sebum. Seborrhoea usually develops during the period of sexual maturation due to disturbances in the endocrine (sexual in particular) glands.

Seborrhoea *adiposa* and seborrhoea *sicca* are differentiated.

Seborrhoea *adiposa* (s. *oleosa*) gives an oily lustre to the skin, makes it rough and porous. Seborrhoea attacks the haired part of the head, the nose, the forehead, cheeks, chin, the central parts of the back and the chest. Seborrhoea *sicca* (dandruff) upsets the normal process of cornification to cause desquamation (dandruff), it is often attended with itching of the head. Dust and dirt get into the dilated openings of the hair follicles to mix with the suet (sebum) and to form comedones (black-heads). Seborrhoea of the haired skin of the head thins hair in women and causes baldness in men.

*Treatment* Improvement of the general regimen and treatment of the accompanying diseases are essential. Preparations of pure sulphur (0.5 g, three times a day for a month), preparations of arsenic and iron, vitamins B<sub>12</sub> and A are given per os, and externally used are alcoholic solutions and ointments containing sulphur (3-5%), resorcinol (1-2%), camphor (2-5%), and salicylic acid (1-2%).

Acne simplex (*vulgaris*) is a pyogenic inflammatory disease of the sebaceous glands. Usually affects persons from 14 to 22 years of age suffering from seborrhoea. A hair follicle is closed by a plug of suet due to insufficient tone of the skin muscles, the sebaceous gland thus fails to empty completely. Comedones are formed by dirt and dust mixed with the suet, and when staphylococcal infection joins, the sebaceous gland inflames to cause induration of the surrounding tissue. Common acne affects mainly the face, chest and the back. The pustules are pointed nodules (the size of a pea). They heal to leave cyanotic spots. Deep acne leaves scars.

*Treatment* is the same as in seborrhoea, but preparations against pyogenic infection should also be given. Antibiotics,

vitamins, sexual hormones (hexestrol, folliculin), immuno-therapy is also effective. If the number of lesions is small they may be removed by diathermocoagulation.

### MALIGNANT TUMOURS OF THE SKIN

Cancer of the skin arising from epithelial cells is called epithelioma, melanoma, the cancer arising from melanin pigmented cells, occurs less frequently.

Epithelioma often arises from precancer states of the skin (e.g. localized disturbances in skin cornification). Constant mechanical stimulation, exposure to radiant energy, X-rays, etc., also favour the development of cancer of the skin. Basal cell carcinoma and spinocellular (prickle cell) epithelioma are differentiated.

*Basal cell carcinoma* A small painless opalescent nodule or nodules develop on the nose, eyelids, forehead, less frequently on other parts of the skin. These grow to fuse into larger nodules ulcerating at the centre. The bottom of the ulcer is smooth, as if polished, and covered with a crust. The ulcer is circumscribed by a dense ridge consisting of nodules (Fig. 53). The disease progresses slowly, its course is relatively benign, and is not, as a rule, attended with metastasizing.



Fig. 53 Basal cell carcinoma

*Spinocellular epithelioma* develops usually on the lower lip, the genitals, in the region of natural orifices (mouth, nostrils, etc.) and is characterized by more rapid and malignant course. Nodules or wart-like papillae on the mucosa turn in a few months into an ulcer with firm elevated margins and a bleeding bottom. Cornification foci are sometimes seen on the bottom. The ulcer promptly increases in size to destroy large areas of the skin (nose, lip, etc.) with

involvement of the adjacent lymph nodes (metastases) If radical treatment is not given the patient dies in 1-1.5 year

*Treatment* Radical surgery, X-ray, radioactive isotopes, and Gordeyev fluid injections are effective Small epitheliomas may be removed by cryotherapy and diathermocoagulation Spinocellular cancer is treated at oncological institutions

Melanoma often develops from a nevus after its injury (cutting, burning, etc ) The pigmented spot begins growing, bleeding, and ulcerating A red circle develops round the spot The focus metastasizes promptly into the internal organs to cause death

*Treatment* The patient is given surgical and radiotherapy at specialized oncological institutions Early diagnosis is essential

*Prophylaxis* of malignant diseases of the skin consists in early diagnosis and timely treatment of precancer states, in mass-scale periodical examinations and health education of population

## Chapter 2

### Venereal Diseases

Venereal diseases (from Latin *Venus*, the goddess of bloom and beauty) are mainly transmitted by sexual contact. This group of diseases comprises syphilis, gonorrhoea, trichomoniasis, soft chancre (chancroid) and the so-called fourth venereal disease. Chancroid and the fourth venereal disease are completely eradicated in the Soviet Union.

#### SYPHILIS

This is a chronic infectious disease caused by *Treponema pallidum* (spirochaete). All organs of the human body are affected by the disease, namely the skin, mucosa, internal organs, and the nervous system. *Treponema pallidum* was discovered in 1905 and called so because it fails to be stained (pallid) and is therefore usually visualized in a microscope against the dark field of vision. *Treponema* is a thin spiral thread (hence the name spirochaete) with 8 to 14 regular coils (Fig. 54). The microorganisms are unable to survive outside the body. They perish on drying, at temperatures above 60°C, and from disinfecting agents such as soaps, etc., but are rather stable at lower temperatures and in moist environment. They can survive in canned blood during 3 to 5 days and donor should therefore be thoroughly tested for syphilis.

It has been established that treponemas (in addition to the spiral-shaped microorganisms) can have the configuration of a sphere (cysts, L-forms). This transformation occurs when the conditions become unfavourable. Injuries (in the wide sense of the word) favour back development (reversion) of *Treponema pallidum* into its initial spiral shape, which causes clinical exacerbation of syphilitic infection. Apart



Fig 54. *Treponema pallidum* (in the dark field of vision)

from physical, psychic, or medicamentous injury, the reversion into the spiral shape may be stimulated also by grave acute diseases, chronic infections, or intoxications

*Pathways of Infection* The source of spreading of the infection is a person affected by syphilis and having active contagious manifestations of the disease. Infection with syphilis may also be caused by the material containing *Treponema pallidum* when it gets on the skin or mucosa with broken continuity. *Treponema pallidum* cannot penetrate intact skin or mucosa, but the discontinuity may be insignificant and invisible to the eye.

Syphilis is transmitted mainly during sexual contacts, such as the sexual intercourse, but petting, or breast-feeding may also become the cause of infection. Cases with infection by ways other than sexual (innocentum) are less frequent. The infectious material (exudate, etc.) may be transmitted through the use of domestic objects such as forks, spoons, etc. Medical personnel may also be the source of spreading the infection if tools (stomatological tools, vaginal specula, etc.) are not sterilized properly before use. Medical personnel can be infected by syphilis if proper care is not taken.



during examination of contagious patients. Cases with occupational infection of obstetricians, gynaecologists, stomatologists, venereologists and laboratory workers, who deal with contagious material, are known. To preclude possible infection, special care of the skin should be taken so that there were no even minor cracks on the examining hands. A 0.5-1% solution of chloramine should be used to disinfect hands after examination of patients especially so if the disease is in the active stage. Soap should also be used to wash hands. Cases with transmission of syphilitic infection through direct transfusion of blood are very rare.

### General Course of the Disease

It has been established in animal experiments that treponemas begin propagating rapidly during the very first hours and even minutes after infection. First they penetrate deeper tissues and the adjacent lymph nodes at the site of ingress, and later are carried by the lymph and blood into various body tissues and organs. The first signs of the diseases however appear only in 3 or 4 weeks. The period that passes from the moment of infection till the appearance of the first signs of the disease (hard chancre) is called the *incubation period*. During this time the immunological system of the body is reconstructed.

Normal course of syphilis is characterized by alternation of active and latent periods. The primary, secondary and tertiary syphilis (following one after another) are active stages of the disease. Late syphilis of the central nervous system and the internal organs are also differentiated. Persistent symptomless course of syphilis is also known to occur. Syphilis of the internal organs or seropositive tests are revealed in persons in many years following the infection in the absence of primary symptoms of syphilis. Symptomless syphilis may probably develop in persons with L-form (or cysts) of *Treponema pallidum*.

The primary stage of the disease (primary syphilis) is manifested by the development of a hard (true) chancre, regional scleradenitis (concurrent bubo) and, less frequently, lymphangitis. Hard chancre is the most characteristic symptom of primary syphilis.

Hard (indurated) chancre is the primary syphilitic sore that develops at the end of the incubation period (normally in 3 or 4 weeks) at the site of entrance of the infection\*. The usual localization of the chancre is the skin or mucosa of the genitals, but it may also develop on the thighs, the pubis, and the abdomen. The primary sore may also develop on the lips, tongue, tonsils, eyelids, fingers, etc.

The clinical picture of hard chancre is quite specific. The sore is usually round or oblong, resembling a saucer, with distinct margins, sizing to the little finger nail. The sore is meat-red or has the colour of rot suet, its margins are slightly elevated to form a saucer. The serous exudate is scant, it gives lustre to the sore (Figs 55 and 56). The most characteristic sign of a hard chancre is induration that can be palpated at the base of the lesion (hence the name hard, or indurated). Ulcerated hard chancres occur less frequently, the margins of the lesion are higher and the infiltration is more pronounced. On healing the ulcerated hard chancre leaves a scar, while the eroded chancre leaves no traces. *Treponema pallidum* can easily be found in the exudate when viewed in the dark.

Atypical hard chancres, such as amygdalitis, indurated oedema, or paronitium, are rare. If a hard chancre is aggravated by a pyogenic infection, diffuse redness and oedema become painful, the exudate is ample and purulent. Hard chancre may be aggravated by phimosis (the condition when the foreskin cannot be drawn back over the glans due to oedema and inflammation of the foreskin), paraphimosis (strangulation of the glans by the foreskin ring), gangrene

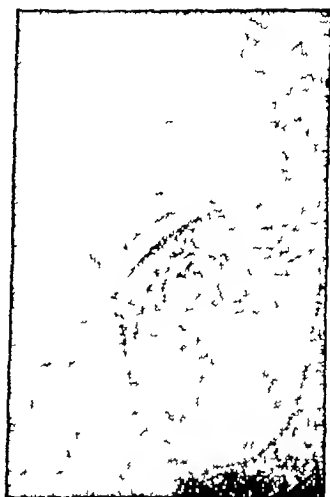


Fig 55 Primary lesion of syphilis (syphiloma)

\* Longer incubation periods are noted at present because of wide use of antibiotics for other diseases

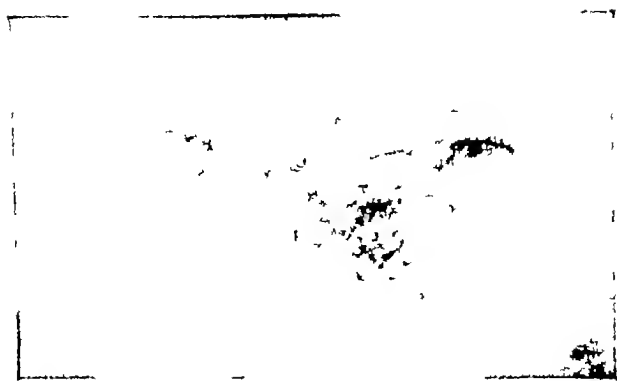


Fig 56 Hard chancre of the lip

(necrosis of the chancre bottom with formation of a crust) and phagedenoma (vast and deep necrotization of the surrounding tissues)

Regional scleradenitis, or the accompanying bubo, develops in 7-10 days after the appearance of a hard chancre. The adjacent lymph nodes (usually the inguinal ones) grow to the size of a bean or a nut and become dense. They do not fuse with one another or the surrounding tissues and skin, and are painless. The overlying skin remains unchanged. Syphilitic lymphangitis (inflammation of lymphatic vessels) is the third (rare) symptom of the primary syphilis. The affected vessel (normally on the back of the penis) can be palpated as a firm painless cord.

### Primary Syphilis

The first stage of the disease is divided into primary seronegative syphilis, lasting for 3 or 4 weeks (from the moment of appearance of hard chancre till the time when the serological tests, such as the Wassermann's reaction and precipitation test, become positive) and primary seropositive syphilis, that begins when the serological reactions become positive and till the signs of primary syphilis subside or (more frequently) till the appearance of eruptions specific for the secondary stage of the disease. If the signs of the secondary stage do not appear while those of the first stage disappear (often due to the specific therapy), the patient is said to be

in the primary latent stage of syphilis. Normally eruptions of the secondary stage appear in 5-7 weeks after development of hard chancre, or 8-10 weeks after infection. Few days preceding the eruption, the patient may feel headache, pain in bones and joints, general weakness, etc.

### Secondary Syphilis

Secondary syphilis is characterized by development of many multiform lesions on the skin and mucosa. This stage is divided into secondary early syphilis, when eruptions develop for the first time, and secondary recurrent syphilis, when the eruptions develop again after an interval. If the disease is not treated, secondary syphilis may recur several times in the lapse of 2 to 4 years. The intervals in between relapses of eruptions are known as secondary latent syphilis. Development and disappearance of the eruptions during the secondary stage of the disease, as well as the morphological characteristics and amount of the eruptions, are associated with the periodic activity of *treponemas pallidum* and their interaction with the body of the patient. The eruptions of the secondary stage (syphilids) are characterized by generalized localization on the body, round shapes and distinct margins of the lesions, the absence of tendency to fusion, pinkish-red colour (with a cyanotic tint), the absence of subjective disorders, and benign character (eruptions resolve without leaving any trace). Secondary syphilids include vascular maculae (roseola), nodules (papules), and (much less frequently) pustules. In *early secondary syphilis* the syphilids are smaller, their quantity is ample, arrangement symmetrical, while in *secondary recurrent syphilis* they are larger, their number is smaller, symmetry is absent, and a tendency to grouping in garlands, arches and other patterns is marked. The Wassermann's reaction and precipitation test are always markedly positive (4+ or 3+) in secondary syphilis.

**Roseola or macular syphilid** is the most common lesion of secondary syphilis. This is a rose-coloured spot that disappears when is pressed upon. The syphilid is rounded, it does not rise above the skin level (elevated urticarial roseolas sometimes occur as well). The size of a roseola is about

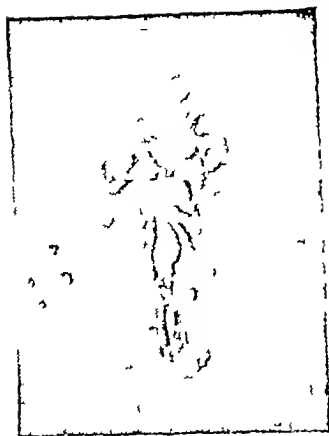


Fig 57 Syphilitic papules  
(condylomas)

that of a lentil (see Plate 2) The eruption does not scale off, and resolves to leave no trace on the skin Roseola is usually located on the sides of the trunk, on the chest, the abdomen, and the upper extremities Roseolas develop gradually, during one or two weeks, they remain unchanged basically for one or three weeks, and then fade and subside

Syphilitic nodules or papules are frequently occurring syphilids of the secondary stage These lesions develop in the papillary layer of the corium The papules differ in size but commonly they are the size

of a lentil (*lenticular papules*) and less frequently the size of a millet grain (*miliary papules* or *lichenoid syphilids*) Lenticular papules are ham-coloured regular hemispheres with distinct margins, they do not fuse with one another (Plate 3) The syphilids often scale off by the periphery (Biett's collar) Miliary papules are found round the orifices of hair follicles (mostly in asthenic patients, for example with tuberculosis) Large nodules (about the size of a dime) are called *coin-shaped papules* When affected by friction, or irritated by various discharge, the papules arranged about the anus, on the genitalia, or in the skin folds may grow in size to form *hypertrophic papules* that fuse into *condylomas lata* (flat papules as seen in Fig 57)

Condylomas, hypertrophic papules, papules in skin folds often erode (from friction) and become weeping, their exudate contains many spirochaetes These patients are therefore highly infectious

Pustulous syphilids occur less frequently than macular and papulolenticular syphilids They are normally found in asthenic patients or in those abusing alcoholic drinks In appearance they resemble superficial or deep pyodermitis, but syphilids have more pronounced hyperaemia and there is a denser induration of the tissues in the absence of pain



Fig 58 Syphilitic leukoderma

Secondary syphilids on mucosa occur frequently Syphilitic papules are also found in the mouth, the mucosa of the genitals (labia majora and minora), and in the anus Because of maceration their colour is whitish, the loosened epithelium easily scales off and becomes eroded (Plate 4) The papules often fuse Patients with eroded papules of the mucosa (syphilitic papular tonsillitis in particular) are extremely infectious and are a danger to the surrounding people (to say nothing of those who come in sexual contact with the patient)

Macular syphilids on the mucosa may develop as *erythematous syphilitic tonsillitis* It differs from common catarrhal tonsillitis by distinct margins of redness, and painless swallowing.

Syphilitic alopecia may develop in *small foci*, it may also be *diffuse* or *mixed* The hair may thin in small rounded foci without any inflammatory phenomena or scaling off The

hair will recover completely in a few months. In diffuse alopecia the hair falls off over the entire head (with prevalence however of the temples). Alopecia usually occurs in patients with secondary recurrent syphilis.

Leucoderma or pigmented syphilid occurs in patients not sooner than in 5-6 months after the infection (i.e. during secondary recurrent syphilis). Discoloured spots surrounded by a yellowish-brown skin develop on the lateral and dorsal surfaces of the neck, in the armpits, and on the sides of the chest. The spots are round or oval. Leucoderma resembles lacework or lattice (Fig. 58). Normally it is attended with pathological changes in the cerebrospinal fluid. Leucoderma subsides in a few or more months, sometimes irrespective of specific therapy.

Patients with secondary syphilis develop pathological changes in the nervous system (for example, pathological changes in the liquor) as well as in the internal organs and bones. These changes are however benign and subside (especially under the effect of therapy).

The secondary stage of syphilis is especially contagious because of erosions on the skin and mucosa, and also condylomas lata and other eruptions of the secondary stage. Patients with secondary syphilis are an epidemiological problem.

### Tertiary Syphilis

The third stage of the disease develops in a small number of patients who were improperly treated for syphilis, or remained untreated at all. Even in the absence of treatment for syphilis, the third stage of the disease does not always occur. Development of tertiary syphilis is favoured by injuries, chronic diseases and intoxications, alcoholism in the aged. Normally tertiary syphilis develops in 3-4 years and in rare cases even in decades after infection.

Tertiary syphilis is very rare in the Soviet Union, although in the tsarist Russia its incidence was rather high, in rural areas in particular.

**Tertiary syphilids** (gummatous and nodular syphilids) develop on the skin, in the subcutaneous connective tissue, in muscles, bones, viscera, and the nervous system. Their number

is not great nodules develop in scores and gummas are mostly single. Their course is malignant and they leave scars (which may endanger the life of the patient when found in the vital organs), they heal very slowly if untreated, and are not very infectious since spirochaetes are few and reside inside deeper layers of indurated tissues, the syphilids are readily cured by antisyphilitic preparations. It should be remembered that the serological reactions are negative in 25-35% of patients with tertiary syphilis.

*Nodular syphilids* develop on a small site of the skin, their arrangement is normally asymmetrical. The nodule is a hemisphere or a flat, copper-hued formation with a cyanotic tint, its size is that of a cherry kernel, the consistency is firm, the margins are distinct. The infiltration is always attended with necrosis of the affected tissue (with atrophy of the skin), sometimes ulcers are formed which leave scars. Nodules appear unevenly and resolve in their various stages to form 'cicatricial mosaic' (Plate 5) by which tertiary syphilis can be diagnosed retrospectively in many years. The nodules may develop in groups with or without fusing into larger nodules which heal in the centre while new foci develop on their periphery (serpiginous syphilids). Less frequently occur nodular syphilids, which fuse into flat papules, and dwarf syphilitic nodules (the size of a millet grain). Nodular syphilids do not cause subjective disorders.

*Gummatous syphilid* or *gumma* is a painless node formed in the subcutaneous connective tissue which is not bounded with the skin or the surrounding tissues. Its size is that of a walnut. The node grows in size to fuse with the skin and lose its mobility. The skin turns cyanotic-red (Plate 6) and becomes painful. The node softens at the centre and opens by a small orifice through which a viscous jelly-like exudate resembling the glue gum arabic (hence the name gumma) is discharged. The orifice increases in size to form an ulcer with firm abruptly descending edges. There is a gummatous core of necrotized tissues at the bottom of the ulcer (Plate 7), the core is separated slowly and the ulcer heals to leave a scar with a depression. Normally only one gumma develops in the patient, several gummas develop less frequently.



Gummas usually develop on the anterior surface of a leg, on the forehead, or a forearm

Tertiary syphilids (gummas and nodules) are often found on the nasal mucosa, the soft palate, and the uvula. When the bones of the nose are involved, the ridge becomes depressed, and the nose looks like a saddle. The bone of the septum may be perforated. The hard and the soft palate may be perforated as well, the uvula and the soft palatine tissues disintegrated, and food will thus get from the mouth into the nasal cavity, the voice becomes nasalized.

Gummatous osteoperiostitis or osteomyelitis often develops in the tibia and the bones of the cranium. The infiltration is either ossified to thicken the bone or disintegrated to form an ulcer with subsequent cicatrization.

Affections of the internal organs and the nervous system in tertiary syphilis may endanger the life of the patient. The most common affection is syphilitic aortitis. It develops in 10-20 years after infection and results in defects of the aortal valves and aneurysms. Syphilitic myocarditis, hepatitis, gummas of the kidneys, liver, brain and other organs may also develop.

Late syphilitic meningitis, syphilis of the cerebral vessels and the spinal cord may cause paresis, paralysis, loss of sensitivity, and other complications.

**Parenchymatous syphilis of the nervous system.** Progressive paralysis (tabes dorsalis) develops in affection of the brain or spinal cord.

### Congenital Syphilis

Early in the 20th century it was established that *Treponema pallidum* can penetrate the foetus only through the placenta of a mother with syphilis. This discovery disproved a former conjecture that syphilis could be transmitted to the foetus by its father. An intact placenta is impermeable to *Treponema pallidum* but the spirochaetes change the placenta and it no longer remains an obstacle in the pathway of *Treponema pallidum*. The pathogenic microorganisms penetrate the foetal tissues through the veins and lymph vessels of the umbilicus beginning with the fifth month of pregnancy when placental blood circulation is established.

If syphilis is untreated, pregnancy ends in a miscarriage at the 5th or 6th month, the mother can deliver a premature infant or a stillbirth may occur, a premature infant or an infant born at term may be infected with syphilis. The probability of bearing a syphilitic infant increases if the mother has an early syphilis, 'aggressiveness' of syphilitic infection decreases with age of the disease.

Cases are possible where *Treponema pallidum* does not penetrate into the foetus but the sexual cells, the embryo or the foetus (till the fourth month of pregnancy) get affected due to syphilis in the mother or the father. Newborns may have various psychic affections (oligophrenia, psychopathic behaviour, etc), they may have symptoms of organic affection of the nervous system and bone dystrophy. In contrast to true congenital syphilis (resulted from penetration of treponemas into the foetus) these disorders are called **parasyphilitic**.

Congenital syphilis of the foetus, infantile syphilis, syphilis of children (from 1 to 4 years of age), and late congenital syphilis are differentiated.

*Prophylaxis* of congenital syphilis may be ensured by early diagnosis of syphilis in women, their energetical treatment before and during pregnancy, prophylactic measures at obstetric institutions, such as regular examination of the skin and mucosa, blood tests (Wassermann reaction) during the entire course of pregnancy, and health education. Children with active symptoms of congenital syphilis are born in very rare cases in the Soviet Union.

Syphilis of the foetus is characterized by drastic changes in the internal organs. The liver and the spleen are sharply enlarged and firm, large amounts of spirochaetes are found in them. The lung tissue becomes indurated as well (white pneumonia). Syphilitic osteochondritis and osteoperiostitis of long tubular bones and the ribs occur. The foetus usually dies between the sixth and the seventh obstetrical month of pregnancy. The skin of the stillborn is macerated, wrinkled, and flaccid.

Congenital syphilis of infants (infantile syphilis) is manifested either at birth or (more frequently) during the first two months of life, or else at the age of 2-4 months. The disease is manifested by development of multiform eruptions

of the skin, mucosa, affections of the bones, viscera, the nervous system and the organs of senses The infant grows slowly, it is asthenic and restless

*Diffuse infiltration* (thickening and induration of the skin, membranous desquamation, development of deep cracks that leave scars round the mouth for the entire life) develops on the skin of the face (cheeks, lips, chin, forehead), the palms, soles, and buttocks (Plate 8) *Pemphigoid syphilids* (bullae with seropurulent exudate, the size of a pea or a lentil, encircled by indurated margins) develop on the soles, palms, sometimes on the legs and forearms

*Syphilitic papules* in infants with congenital syphilis resemble those of secondary acquired syphilis *Syphilitic rhinitis* often occurs seropurulent exudate dries into crusts to interfere with nasal breathing which becomes noisy and whistling, nasal breathing becomes infeasible in some cases This interferes with breast-feeding and causes loss of infant weight

*Syphilitic osteochondritis* of long tubular bones often occurs It can be revealed during early X-ray examination If the pathology is significant (with separation of epiphysis and diaphysis) the infant holds its affected arm tight against the trunk, flexes the defective leg on the thigh and abdomen, abstains from active movements and cries in passive movements

Diffuse infiltrative process with subsequent sclerosis affects the liver, spleen, kidneys, lungs and the testes Meningitis, meningoencephalitis, and hydrocephalus also occur

Infants with congenital syphilis grow slowly, their development is retarded, they are often ill, and die from other diseases

**Congenital syphilis of childhood** occurs in children from 1 to 4 years of age Its symptoms are scarce Weeping and eroded papules and flat condylomas in the region of the anus and the genitals would usually develop This period is called condylomatous Periostitis of the extremities and affections of the eye membranes are not frequent

**Late congenital syphilis** is revealed in children from 6 to 15 years of age and over The disease resembles tertiary syphilis gummas develop on the skin and mucosa, in the

internal organs, bones, and the nervous system (gummatous meningitis). Specific symptoms, such as Hutchinson's triad and sabre shin are seen in late congenital syphilis as well. The *Hutchinson triad* includes parenchymatous keratitis (reddening and opacification of the cornea, photophobia, increased lacrimation with persistent deterioration of visual acuity), syphilitic labyrinthine disease (partial loss of hearing, noise in the ears) and Hutchinson's teeth (dystrophy of the central upper incisors which have the shape of a chisel with a crescent-like depression at the free edge)

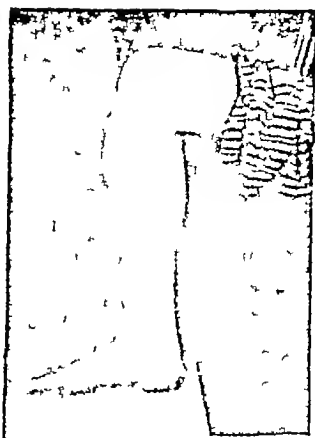


Fig 59 Sabre shin

*Sabre shin* (Fig 59) is characterized by a marked anterior convexity of the tibia (due to past osteochondritis) and nocturnal pain.

Tabes dorsalis and children's progressive paralysis are found in some patients

Serologic tests (Wassermann's reaction and precipitation test) Diagnosis of syphilis is established by clinical signs of the disease, by tests for *Treponema pallidum*, by collecting anamnestic data, and by confrontation (revealing sexual contacts of the patient) No less important for correct diagnosis of syphilis and its successful treatment are the results of serologic tests It should be remembered that serologic tests of the blood may be negative in some syphilitic patients (for example in 25-35% of patients with active tertiary syphilis) Moreover, serologic tests may be positive in persons who are not affected with syphilis The reactions are then called *nonsyphilitic* or *pseudosyphilitic* positive serologic tests.

An important means to differentiate between true syphilitic and pseudosyphilitic positive serologic tests is a comparatively recently devised reaction of immobilization of *Treponema pallidum* which is practically absent in persons not affected by syphilis Blood is taken from a patient on a fasting stomach or in at least four hours after a lean meal Blood should not be taken from persons with elevated tem-

perature or after use of alcoholic drinks From 5 to 7 ml of blood should be taken from cubital veins of adults and from cranial or jugular veins of children, or else from a cut in the heel The blood sample is taken by a needle with a wide lumen into a dry clean test tube, with or without the syringe (by gravity) The needle and the syringe should be absolutely dry or rinsed with physiological saline solution (to preclude haemolysis). Blood is discharged from the syringe (after removing the needle) on the wall of the test tube to preclude foaming The test tube is then stoppered by cotton wool or gauze (Do not use cork stopper) The test tube is allowed to stand for two hours at room temperature and a clot is then precipitated (by slightly tapping the test tube against the palm or by using a glass rod) A clear yellowish liquid (serum) gradually separates over the clot.

If the serum specimen cannot be delivered immediately to the laboratory, it should be dried and posted to the serological laboratory To that end, accurately one millilitre of the serum should be transferred by a pipette or a syringe onto a strip of cellophane, white paper, or a piece of dry window glass in one drop (or two 0.5 ml drops) Next, 2-3 drops of a 40 per cent food sugar solution should be added to each 0.5 ml portions of the serum (to ensure long preservation of its properties) The dry serum should be used for the serologic test within ten days.

## Treatment

The sooner specific treatment of syphilis begins the better are the prospects for its successful cure Treatment should therefore be begun as soon as possible after the diagnosis has been established The treatment of early active stage of the disease should be commenced during the first 24 hours Syphilis is treated in the Soviet Union in compliance with special instructions adopted in the Ministry of Health of the USSR

At the present time, the main specific preparation against syphilis is penicillin (sodium or potassium salt of benzyl penicillin) and its derivatives (long-acting derivatives such as ecmonovocillin, bicillin-1, bicillin-3, bicillin-5). If peni-

cillin is not tolerated by the patient, erythromycin should be given

If the patient does not tolerate erythromycin, or penicillin injections, phenoxymethylpenicillin can be given per os in doubled doses (compared with an injection dose of water-soluble penicillin). Water-soluble penicillin should be injected intramuscularly at a three-hour interval (night including) in a dose of 50 000-75 000-100 000 units, depending on the body weight of the patient. Ecmonovocillin should be injected once a day in a dose of 600 000 units, bicillin-1 and bicillin-5 should be injected once in 5 days, and bicillin-3, in four days. The size of a single dose of bicillin depends on the body weight of the patient. For example, a dose of 1 200 000 units is given to a patient weighing under 60 kg, 1 500 000 units to patients weighing from 60 to 80 kg and 1 800 000 units over 80 kg.

Long-acting preparations (suspension) should be injected intramuscularly into the upper outer quadrant of the buttocks by a two-step injection technique to preclude embolism that may occur if the needle enters incidentally a blood vessel. (For intramuscular injections in more detail see page 33.)

Erythromycin is given per os, 0.3 g (300 000 units) five times a day (at 4-hour intervals except during the night sleep), or 0.25 g (250 000 units) at a 6-hour interval. The total dose should be 30 g for patients weighing under 60 kg, 35 g to patients weighing from 60 to 80 kg and 40 g to patients weighing over 80 kg.

Children are treated in compliance with special instructions, depending on age.

Salts of bismuth and iodine preparations are also given to syphilitic patients in addition to antibiotics. Iodine preparations should be given in the intervals between other courses (to patients with late stages of the disease).

The *bismuth preparations* include buiochinol, bismoverol (oil preparations) and pentabismol (water-soluble).

*Buiochinol* is given in a dose of 1 ml a day, or 2 ml every other day, or 3 ml once in three days. The total dose per course is from 40 to 50 ml.

*Bismoverol* is given in 15 ml doses (0.5 ml daily) twice a week, the total dose per course being 20 ml.

*Pentabismol* is given in 2 ml doses every other day, the total dose being 40-50 ml per course

Vials containing *biiochinol* or *bismoverol* should be placed in a water bath (40-45°C) before injections. The warmed up preparation should then be jolted to obtain homogeneity of the suspension. *Biiochinol* and *bismoverol* should be injected intramuscularly by a two-step procedure into the upper outer quadrant of the buttocks (see page 33). *Pentabismol* is injected by a single-step technique

*Iodine preparations* are used as sodium or potassium iodide solutions, one tablespoonful three times a day after meals (in half-glass of milk). The concentration of the solutions should be raised gradually from 2-3 to 7-8%. The preparations should be given for 3 or 4 weeks

*Arsenic preparations* (*novarsenol*, *myarsenol*, *osarsol*) and mercury preparations are now avoided because of their high toxicity and grave complications that they may provoke

In compliance with the instructions of Ministry of Health of the USSR (adopted in 1976) there are several *schemes* for treatment of syphilis, but two of them are mainly used in practice: chronic alternating and continuous therapy with antibiotics alone (without using bismuth salts), which is given to patients with primary and early secondary syphilis, and (only in some cases) secondary recurrent syphilis

Chronic alternating therapy consists in repeated courses of antibiotics (*penicillin*, *ecmonovocillin*, *bicillin*) with or without bismuth salt preparations. Bismuth preparations may be given along with antibiotics or in alternating courses with antibiotics. Intervals should be made between the alternating courses, namely two or three weeks between antibiotic courses and four weeks in alternation of antibiotic and bismuth therapy. The number of courses in chronic alternating method depends on the stage of the disease: the later the stage of syphilis, the greater the number of courses

The course dose of antibiotics should be determined depending on the stage of the disease and the body weight of the patient. For example, a dose of 100 000 units of *penicillin* per kg of body weight is prescribed to patients with primary seronegative syphilis, 120 000 units per kg of body weight to patients with early secondary syphilis and pri-

mary seropositive syphilis, and 140 000 units per kg of body weight to patients with secondary recurrent, tertiary, and late forms of syphilis of the internal organs and the nervous system

In treating patients according to a continuous schedule one third of the total dose of antibiotics should be given as water-soluble penicillin and two thirds as long-acting drugs (bicillin). The total dose prescribed depends on the body weight of the patient and the stage of the disease. 300 000 units of antibiotic per kg of body weight should be given to patients with primary seronegative syphilis, 480 000 units per kg of body weight in patients with primary seropositive syphilis, 600 000 units per kg of body weight to patients with early secondary syphilis, and 800 000 units per kg of body weight in secondary recurrent syphilis.

When selecting the schedule for treatment of syphilis, the age of the patient, his (her) general condition, the presence of accompanying diseases that may contraindicate this or that preparation, tolerance of a given preparation and other factors should be taken into consideration. For example, bismuth preparations are contraindicated to patients with diseases of the liver or kidneys.

Non-specific therapy is widely used along with specific preparations for treatment of syphilis. This includes pyretotherapy (pyrogenal, prodigiosan, injections of sulphur suspension, milk, etc.), vitamins, U-V rays, oxygen therapy, biogenic stimulants (aloe, placental and vitreous body extracts), and preparations which strengthen body resistance to syphilitic infection and facilitate its cure.

*Preventive treatment* is given to persons who had sexual contacts with patients in active stage of syphilis, or to persons in close everyday contact. This especially holds for children of syphilitic parents. Preventive treatment should be carried out in compliance with special instructions. After the therapy of syphilis has been finished, the patient is followed up for terms from 2 to 10 years (depending on the stage of the disease at which the therapy has begun). During the follow-up period, the patient is examined once in three-six months and his blood is tested serologically. At the end of this period the patient is given a final clinico-laboratory examination and is no longer observed.



**Complications of antisyphilitic therapy.** Complications may develop during treatment of syphilitic patients. Penicillins may cause allergic reactions (anaphylactic shock, toxicoderma, acute oedema, various eruptions) and toxic phenomena such as headaches, haemopoietic disorders, etc. Disorders in the intestinal flora may favour the development of candidiasis. Bismuth preparations may cause complications on the part of the kidneys ('bismuth cells', protein and casts in the urine) and irritation of the mouth mucosa (gingivitis, stomatitis, 'bismuth margin'). Iodine preparations may provoke rhinitis, conjunctivitis, and 'iodine acne'.

Prophylaxis of complications during antisyphilitic therapy consists in thorough examination of the patient before treatment, the patient should be questioned as regards his tolerance of antibiotics in the past and his response to various preparations given for syphilis should be watched thoroughly as well. The patient should observe strictly the prescribed regimen, take high-calorie food, vitamins and keep his teeth and gums clean.

The role of a medical nurse in treating syphilitic patients is very important. Accurate performance of all procedures prescribed to the patient by the doctor, accurate dosage of penicillin for injections, observation of the required intervals between the injections, high-skill performance of intramuscular and intravenous injections with strict adherence to aseptic and antiseptic rules, all are the obligatory factors in successful performance of the nurse duties.

For example, if 3-4 hour intervals between injections of aqueous solutions of penicillin are not observed properly, or else if the prescribed dose is decreased incidentally (for example, due to careless suction of penicillin solution from the vial into the syringe, or incorrect calculation of the dose), penicillin-resistant forms of *Treponema pallidum* may be formed in the body of the patient and it will render penicillin therapy inefficient. Improper observation of hospital regimen and neglect of special regulations (e.g. taking alcoholic drinks, spicy foods, etc.) will also produce an adverse effect on the efficacy of antisyphilitic therapy.

Patients with contagious forms of syphilis should be given specially labelled plates, cups, and other table utensils which should be washed separately from plates and dishes.

of other patients. Hot running water should be used for the purpose.

After examination of a patient with active syphilitic manifestations, the medical personnel should wash their hands with a 0.5-1% chloramine solution and then with running water (using soap). Metal spatulas should be boiled in a separate container after use. Syringes, needles, and other tools should be disinfected by commonly known techniques.

### Review Questions

- 62 Name the stages of syphilitic infection (1), (2), (3), (4).
- 63 Name the causative agent of syphilis.
- 64 Hard chancre is (1) a node, (2) vesicle, (3) erosion or ulcer, (4) a nodule, (5) a bulla. Choose the correct answer.
- 65 Name the main lesions of secondary syphilis (1), (2), (3).
- 66 Itching is characteristic of syphilitic lesions, yes or no?
- 67 Rhinitis and pemphigus are characteristic of congenital infantile syphilis, yes or no?
- 68 What is the main medicinal preparation to treat syphilis?
- 69 What is the total dose of biquinol prescribed to treat an adult?
- 70 What is the total dose of bismoverol prescribed to treat an adult?

### Tropic Treponematosis

Tropic treponematoses include pian (framboesia), bejel and pinta. These are infectious diseases which resemble syphilis in their clinical picture and course. The causative agents are treponemas which are similar in their morphological and biological properties to *Treponema pallidum*. Serological diagnosis and treatment of patients with tropic treponematoses do not differ from those of syphilis. What differs them substantially from syphilis is that they are transmitted by routes other than sexual and cannot therefore be classified as venereal diseases. Prophylactic measures consist mainly in control of sanitary conditions in everyday life and observation of personal hygiene.

*Pian* (framboesia or tropic syphilis) occurs mainly in children but is not inherited. Contamination is effected mainly through direct contact. The disease is divided into the incubation, primary and secondary periods. Symptoms of late framboesia develop in 20-30% of patients in 15-20 years after infection.

The incubation period lasts for 3-4 weeks and ends in a prodrome. The primary period is characterized by development of a pianoma, an itching papule which later turns into a pustule. The pustule ruptures to form an ulcer without sclerosis at the base. Vegetation develops on the bottom of the ulcer (raspberry-looking formations). Regional lymphadenitis, and sometimes lymphangitis, attend pianoma.

Another prodrome may develop to indicate the onset of the secondary period of the disease, which is characterized by the appearance of erythematous, vesicular, pustular, ulcerous, papular, lupoid and pigmented frambesids. Aged papules become wart-like formations and resemble raspberry. Hyperkeratosis develops on the soles and palms. The lesions are very painful and the patient avoids weight-bearing on the affected soles (crab gait). Appearance and resolution of frambesids is a continuous process, although latent periods occur. The mucosa is affected in rare cases.

Late framboesia is characterized by gummatous affections of the skin, bones, and joints, which are attended with pain. Periarticular nodes often develop. The nose may thicken due to ossifying periostitis of the face. The speech becomes nasalized due to mutilating rhinopharyngitis. The serological reaction becomes negative in late framboesia. The liquor is not changed.

*Bejel* (endemic syphilis, arab syphilis) occurs mainly among children. The primary affection is usually overlooked. The eruptions look like secondary syphilids, but they persist for longer period (to 8-12 months). Gummatous affections of the skin and the bones may be combined with secondary eruptions.

*Pinta* (spotted sickness) occurs mainly in South and Central America. The disease is mainly transmitted by direct person-to-person contact, and also through dishes, wash-towels, and other domestic objects in common use. Insects are regarded as possible transmitting agents as well.

The primary lesion, a flat itching papule, develops in 1-3 weeks after infection. The papule grows in size and desquamates, thus resembling trichophytosis or psoriasis lesions. The secondary period develops in a few months. It is characterized by formation of many similar papules and plaques which regress to leave spots, varying in colour from violet, blue, black, grey, yellow to orange-red. Depigmentation then follows to give the skin a spotted appearance, which is characteristic of the tertiary period of the disease.

### GONORRHOEA

Gonorrhoea is an infectious disease affecting mainly the urogenital system of man. Men and women get infected with gonorrhoea mainly through coitus. Young girls are infected with the disease almost exceptionally by non-venereal routes. The causative agent of gonorrhoea is *Neisser gonococcus* (Fig. 60). It was discovered in 1879.

The incubation period lasts for 3-5 days but sometimes it increases to 2-3 weeks. In separate cases the disease affects also the joints, the heart, and gonococcal sepsis can even occur. Gonorrhoea can therefore be considered as an infec-

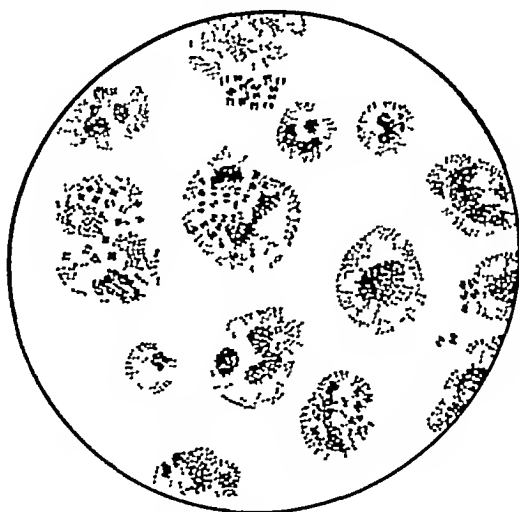


Fig. 60 Gonococci as viewed in a microscope

tion of the whole body, although in most cases it only attacks the urogenital mucosa. Gonorrhoeal conjunctivitis (blennorrhoea) develops due to contamination of the eyes by the hands (pus), blennorrhoea in newborns results from infection of the foetus during its passage through the birth canal of a mother with gonorrhoea.

### Gonorrhoea in Males

A male is infected with gonorrhoea during a sexual intercourse with a sick woman. The disease (*acute urethritis*) begins with an affection of the anterior portion of the urethra (*anterior gonorrhoeal urethritis*). At the end of the incubation period, a male feels itching and burning in the urethra, and cutting pain during urination.

Greenish-yellow pus is discharged from the urethra and the lips of the external urethral opening become hyperaemic and oedematous. When untreated, the process extends in 2-3 weeks onto the posterior urethra to cause *posterior gonorrhoeal urethritis* attended with frequent vesical tenesmus and increasing pain at the end of urination, the last drop of the urine may be stained with blood. The anterior urethra is separated from the posterior one by a sphincter and the pus does not immediately get from the anterior urethra into the posterior urethra. Hence a two-glass test: the patient urinates into two glasses and anterior gonorrhoeal urethritis is diagnosed if the urine is cloudy in the first glass only, and the patient contracts posterior urethritis if the urine is turbid in both glasses.

If untreated, the inflammation subsides and the patient only observes a drop of mucopurulent discharge from the urethra in the morning and feels slight itching and burning in the urethra. This is *chronic gonorrhoeal urethritis*. Pus threads and flakes can be found in the first glass, while the second portion of the urine is clear. Chronic gonorrhoeal urethritis may exacerbate from alcoholic drinks and sexual intercourse. Urination then becomes attended with pain, purulent discharge from the urethra appears again and the urine becomes cloudy.

Chronic gonorrhoeal urethritis, like posterior urethritis,

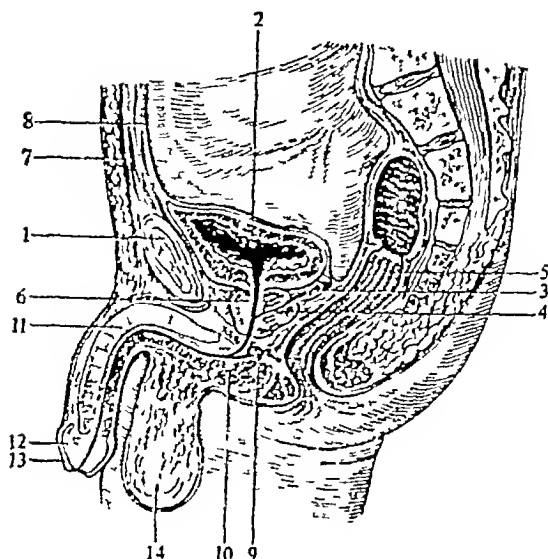


Fig 61 Male pelvis (sagittal section)

1—symphysis pubis, 2—bladder, 3—seminal vesicle, 4—seminal duct, 5—rectum, 6—prostate, 7—abdominal wall, 8—peritoneum, 9—Cowper's gland, 10-12—cavennous bodies of the urethra and the penis, 13—prepuce, 14—scrotum

often provokes inflammation of the prostate, the seminal vesicles and the epididymis (Fig 61)

The onset of *fresh torpid gonorrhoea* is marked by weak inflammation, the urethral discharge is scanty, mucopurulent or mucous, pain is absent or is only insignificant, the first portion of the urine is slightly cloudy, and the second is clear. This course of gonorrhoea is explained by the changes in the properties of gonococci or by the decreased reactivity of the body. Fresh torpid gonorrhoea is of great epidemiological importance since the patient is often unaware of the disease and continues with the sexual life to infect his women partners.

Improper treatment (or absence of treatment), alcohol, decreased resistance of the patient body (associated with concomitant diseases), sexual excitement and other factors may provoke exacerbation of gonorrhoea. Complications of gonorrhoea are gonorrhoeal prostatitis, epididymitis, and vesiculitis.

*Gonorrhoeal prostatitis* (inflammation of the prostate) may be acute and chronic. If the prostatic ducts are involved in the process, catarrhal prostatitis evolves, and if separate glandular lobes of the prostate are involved, the patient contracts follicular prostatitis. Parenchymatous prostatitis develops when all tissues of the prostate are involved. The prostate (or its separate lobules) increases in size, becomes tender to palpation, the patient feels discomfort during defaecation and experiences frequent urges to urinate.

*Gonorrhoeal epididymitis* (inflammation of the epididymis) is attended with pains in the testes, the epididymis increases in size, becomes firm and painful, the scrotum becomes red and oedematous. Epididymitis may cause obstruction of the seminal ducts. Sterility may result from bilateral epididymitis.

*Gonorrhoeal vesiculitis* (inflammation of the seminal vesicles) usually develops simultaneously with epididymitis or prostatitis.

### Gonorrhoea in Females

The subjective feelings are usually insignificant and the woman often may stay unaware of the disease for a long time. As a rule, several organs are involved simultaneously in the gonorrhoeal process. These are the uterine cervix, the urethra, and Bartholin's glands (Fig. 62). This is simple gonorrhoea. If the inflammatory process spreads onto the uterus, the appendages, parauterine connective tissue or pelvic peritoneum, the process is known as ascending gonorrhoea.

Inflammation of the uterine cervix associated with gonorrhoea is called *gonorrhoeal endocervicitis*. It may occur in women with acute and chronic or fresh torpid gonorrhoea. The uterine cervix is oedematous and hyperaemic, scarlet-red erosion can be seen round the external os which liberates mucopurulent exudate. The patients often complain of lower abdominal pains, pains in the lumbar region, but the absence of complaints is more frequent.

The urethral orifice in *gonorrhoeal urethritis* is hyperaemic and oedematous. Pus is discharged from the urethra. Pain and burning during urination are not marked.

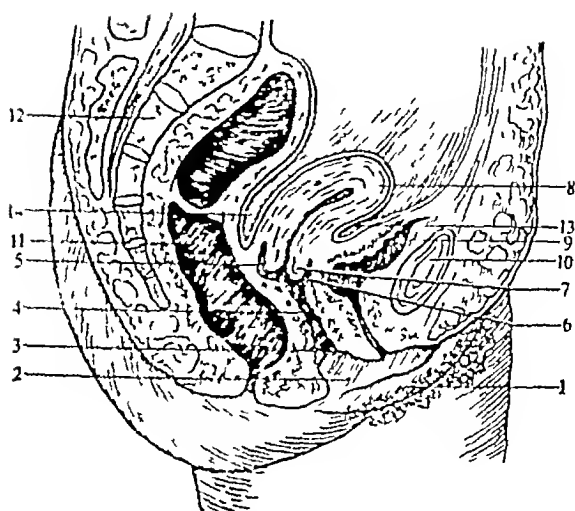


Fig. 62. Female pelvis (sagittal section)

1—labium majus, 2—labium minus, 3—vestibule of the vagina, 4—vagina, 5—posterior fornix, 6—anterior fornix, 7—cervix, 8—uterus body, 9—bladder, 10—symphysis, 11—rectum, 12—sacrum, 13—vesicouterine excavation, 14—Douglas' cul-de-sac

*Gonorrhoeal bartholinitis* is marked by inflammation of the glandular duct orifices alone, or the corpus and the entire ducts of the gland may be involved

*Gonorrhoeal proctitis* would normally develop due to penetration of pus from the vagina into the anus

**Ascending gonorrhoea.** Untreated or improperly treated gonorrhoea, sexual intercourse and alcoholic drinks used during gonorrhoeal process, decreased body resistance, and menstrual period favour the development of ascending gonorrhoea. The body temperature rises, the woman complains of lower abdominal and lumbar pains, the discharge from the uterine cervix becomes more ample. If the pelvic peritoneum is involved (adnexitis), nausea, vomiting, constipation, and rigidity of the abdominal muscles add to the clinical picture of ascending gonorrhoea

### Gonorrhoea in Girls

Young girls are usually infected with gonorrhoea by the non-venereal routes if personal hygiene is poor (through the use of towels, chamber-pot, common bed, sponge, and other



objects that may carry secretions containing gonococci) The vestibule and the vagina are attacked by gonococci (*gonorrhoeal vulvovaginitis*) The urethra and the rectal mucosa may also be involved Endocervicitis and ascending gonorrhoea are rare in young girls Fresh torpid gonorrhoea with scanty discharge, insignificant hyperaemia, oedema and weak subjective symptoms is characteristic of gonorrhoea in girls The process may undergo transient exacerbations due to other (children's) infections, chills, etc

### Diagnosis of Gonorrhoea

**Taking smears in males** If the process is acute (acute urethritis, acute prostatitis), a dripping exudate is examined Energetic manipulations are however required to obtain material from deeper portions of the urethra, seminal vesicles or the prostate in the absence of acute inflammation

*Urethral Smears* The first dripping portion of the exudate is removed by a piece of gauze and pus is then taken by the edge of a slide The smear is prepared by a single movement of the slide in one direction over another glass The smearing glass should be pressed tightly against the slide in order to obtain a thin layer convenient for microscopy The smearing glass should be held firmly at an angle of 30-40° to the plane of the slide If the exudate is scant, a smear should be taken in the morning before urination, by slightly squeezing the glands penis and expressing carefully the urethral contents If the exudate from the urethra is absent, the material for microscopy is taken by scraping the urethral mucosa To that end, a platinum loop (or a nichrome loop made of the filament holder of a blown 'Sollux' lamp) is kept in the flame of a spirit (gas)-burner, cooled, and introduced into the urethra to the depth of 2-4 cm In order to preclude injury to the urethra, the loop should be inspected for the absence of acute angles or protrusions The scraped off material should then be transferred by the loop onto the slide A grooved probe may also be used for taking smears

*Smears from the urethral glands and sinuses* are prepared with preliminary massage of the urethra on a straight probe The urinary bladder is evacuated preliminarily and then

filled with 50 ml of well boiled water or mercuric oxycyanide solution (1 : 6 000) The urethra is rubbed for 3-5 minutes and the material is then scraped off carefully by a platinum loop, or threads are separated from the released washing fluid

*Obtaining prostatic fluid* The patient bends forward and with his elbows resting on the table, as if sitting upon the forefinger of the physician who rubs his prostate (The bladder is emptied preliminarily and then filled with 50-60 ml of warm boiled water or mercuric oxycyanide solution, 1 : 6 000) When an opal drop emerges at the urethral orifice, the physician (or a nurse) takes it on a slide and covers with another If it fails, the fluid is released from the bladder and its precipitate examined after separation by centrifuging

*Taking pathogenic material from females.* Vaginal smears are taken by a sterile branch of forceps or a metal spatula, using a new tool for taking material from each new site (The patient is informed preliminarily that she should not urinate in the morning) Urethral smear is taken first The lips of the vulva are separated by the fingers of the left hand and the meatus is exposed Using a tool the exudate emerging from the urethra is transferred onto a clean slide In chronic urethritis it is necessary to rub carefully and slightly the urethra from the inside and thus express the exudate A Cusco speculum is then introduced into the vagina, if assistance is available, two Sims' specula are inserted as well and the cervix is thus exposed to take the cervical exudate (by a sterile tool) onto two slides The material is distributed on the glass in an even layer Using another tool, material is taken from the posterior vaginal vault and transferred onto the same slides The area onto which the material is applied should be marked appropriately with the letters U (urethra), V (vagina) and C (cervix) Smears should be made on two separate glasses since different staining methods will be used If only one slide is used, the smears should be applied in a certain order and labelled accordingly To fix the smear, the slide should be kept over the flame of a burner and sent to the laboratory (supplied with the appropriate notes)

## Treatment

*General treatment* Gonorrhoea is treated in the Soviet Union in compliance with special instructions of the Ministry of Health

The main antigonorrhoeal preparations are antibiotics. Watersoluble *penicillin* is given in a total dose of 3 000 000 units to treat acute uncomplicated gonorrhoea. Patients with complicated and chronic gonorrhoea are given the total dose of 4 200 000-6 000 000 units (depending on the gravity of the affection). The first penicillin injection should contain 600 000 units and next injections 300 000 units, given at 4-hour intervals (with auto-blood for night).

*Ecmonovocillin* is given intramuscularly in 600 000 unit doses at 10-12 hour intervals, bicillin-1 or bicillin-3 doses containing 600 000 units should be injected at a 24-hour interval, or a dose of 1 200 000 units may be given at a 48-hour interval.

*Laevomycesin* is given per os, 0.5 g six times a day during the first two days and then 0.5 g four times a day, the total dose being 6 g per course in acute and 10 g in chronic and complicated gonorrhoea.

*Oletetrin* 1 250 000 units during the first day (500 000 units for the first intake followed by three 250 000 unit doses), on other days 250 000 units should be given 4 times a day, the total dose being 4 000 000 to 7 500 000 units per course. The total dose of *erythromycin* should be 8 800 000-12 800 000 units and over (400 000 units six times a day during the two days, then 400 000 unit doses five times a day). *Monomycin* is given in 500 000 unit doses intramuscularly at 10-12 hour intervals, the total dose being 3 000 000-6 000 000 units.

Other antibiotics are also used *chlortetracycline hydrochloride* (biomycin), *tetracycline*, *kanamycin*. Long-acting sulpha drugs are efficacious as well *sulphamonomethoxin* and *sulphadimethoxin* are given in 1.5 g doses three times a day during the first two days, and then 1 g three times a day, the total dose being 15-18 g per course. Sulpha preparations are prescribed in cases of intolerance of antibiotics or resistance to them.

Immunotherapy is given in all cases with gonorrhoea except acute uncomplicated one.

*Gonovaccine* is given first in doses of 200-300 million microbial bodies intramuscularly, the dose being increased gradually to 1 milliard microbial bodies. The injections are given at 2-3 day intervals (depending on the body response and the dose of the preparation), the total number of injections being 4-6.

*Lactotherapy* (injection of milk) is carried out during three to five days, from 4 to 5 injections altogether. The first injections should be 1-2 ml with a constant increase by 2-3 ml to attain 5-10 ml, depending on the body response. Fresh cow milk is boiled in a test tube for 5-10 minutes, cooled, taken into the syringe through the needle from deep layers, and injected into the outer upper quadrant of the buttocks.

*Autohaemotherapy* consists in 4-6 injections of 5-8-10 ml of autoblood once in three days.

### Local Treatment

Local treatment is unimportant in acute uncomplicated gonorrhoea, while it is very helpful in all other forms.

Irrigation of the urethra from Esmarch's irrigator with a potassium permanganate solution at 38-40°C (1 : 10 000-1 : 60 000) is used to treat urethritis locally. The more acute the process, the more dilute solution of potassium permanganate should be used. A glass end-piece should be sterilized. The patient lies on a bed or stands upright. The irrigator is suspended from a height of 1-1.5 m above the body level. The site round the urethral orifice, glans penis, and the prepuce should be washed by a stream of the solution. The end-piece is then inserted into the urethra and the solution is admitted into it until the patient reports the feeling of stretching in the urethra. The end-piece is then extracted and the solution is allowed to discharge from the urethra. The procedure is repeated 10-12 times.

The anterior portion of the urethra is only irrigated during first days, but later the posterior urethra should also be treated. The end-piece is not retracted from the urethra and the liquid is admitted into it until it reaches the bladder.

and the patient reports an urge to urinate. The urinary bladder is filled several times until the discharge becomes clear.

*Vaginal syringing* is also performed with Bismarck's irrigator and a glass end-piece. The irrigator is suspended at a height of not more than 1 m over the bed level, the patient lies on her back. With the woman in this position the walls of the vagina are better and longer irrigated with the solution, and part of the liquid remains in the vagina after the irrigation is over. The end-piece is introduced into the vagina by its posterior wall with simultaneously feeding the solution into the vagina. The end-piece should reach the posterior vault. The temperature of the irrigating fluid (water) should not exceed 45°C to preclude burns of the genitals or thighs. Vaseline should be applied to the skin before syringing to prevent incidental burning as well. After the syringing has been completed, the patient should stay in the lying position for at least 30 minutes. The end-piece should be sterilized after use.

*Vaginal tamponade* is used in 60-90 minutes after syringing. Cotton wool is commonly used for the purpose which is pressed into a ball (the size of a large tangerine) wound round with a thread with long ends. The tampons are sterilized and introduced into the posterior vault of the vagina exposed by specula. The tampon should be soaked in any medical substance (streptocide emulsion, cod-liver oil, glycerol, etc.). The speculum is then extracted and the tampon is held in place by the finger or using a long forceps. The tampon should remain in the vagina for 8-10 hours. The patient can remove it herself by the thread hanging from the vagina.

*Instillation* of 6-8 ml of 0.25-1% silver nitrate solution and 1-2% protargol into the urethra is another local procedure for treatment of subacute and chronic urethritis.

The instillator should be sterilized in formaldehyde vapour or kept before use in a mercuric oxycyanide solution for an hour. The instillator is introduced to the outer sphincter of the bladder and as it is then pulled back, the medicinal solution is expressed into the urethra. The solution should remain in the urethra for 2-3 minutes. The procedure should be repeated not sooner than in three days. The instilled dose should be 6-8 ml to males and 3-5 ml to females.

If the urethra is constricted, a *bougie* should be introduced.

The procedure should be performed in aseptic conditions the tools and the operator hands should be treated as before an operation. Bougies may be soft (silk and plastic), metal, and composite. Metal bougies should be sterilized by boiling, and plastic ones by short boiling without soda.

Bougienage of the urethra should be done by a physician. Medical nurse should keep and sterilize the tools, assist the physician in carrying out the procedure and observe the condition of the patient.

When carrying out irrigation of the urethra, instillation, and bougienage, the operator should wear rubber gloves.

Hot microcneuma (40-42°) should be prescribed for acute prostatitis and vesiculitis (for 10-15 minutes), massage and diathermy should be given in vesiculitis and chronic prostatitis.

Patients with acute epididymitis should stay in bed or wear a suspensory, diathermy, paraffinotherapy, and hot baths are prescribed for subacute and chronic processes.

Urethritis in *females* is treated locally by irrigations, instillations and application of pure ichthammol. The urethra should be washed by a glass end-piece which is passed into the urethra to the depth of about 1 cm. From 3 to 5 ml of solution are used for instillation. Vaginal baths are given in endocervicitis, syringing with potassium permanganate solution and applying lugol solution are also helpful. Protargol (5 ml of a 3% solution) should be administered into the rectum in proctitis.

Warm potassium permanganate solution should be used to treat chronic gonorrhoea in young girls. A thin rubber catheter should be used for the purpose. The vagina shall also be treated by instillation of 3-5 ml of 1-2% protargol solution. A few drops of 1% protargol solution should be instilled into the urethra using an ophthalmological pipette. **Criteria of cure.** The patient should be tested for cure in 7-10 days of the therapy. To that end a combined provocation is used: a metal bougie is passed into the urethra (for 5-10 minutes) and then 0.5% silver nitrate solution (10 ml) is instilled, gonovaccine is injected intramuscularly (50 million microbial bodies), the patient is recommended to take spicy food and beer. Smears are taken during three days after the provocation.

If the results are negative, the provocation is repeated in a month (in males) Females are given another provocation after termination of the menses (three menstrual cycles) and their blood tested (Wassermann's reaction)

The patient is considered to be cured completely after favourable results of provocations have been obtained

### TRICHOMONIASIS

It has been established now that trichomoniasis is transmitted mainly during the sexual intercourse but the disease is not acknowledged officially as venereal The infection can however be transmitted by non-venereal routes as well (especially in young girls) The disease can be transmitted through the use of common sponge, towel, bed cloths, and other objects upon which a woman with trichomoniasis can leave the microbes

The causative agent of trichomoniasis is *Trichomonas vaginalis* (Donne, 1837) The microorganisms are round, oval or pear-shaped protozoa with four flagella The size of a trichomonas varies from 7 to 20  $\mu$ m

Vaginal trichomonas may be the cause of prolonged and sometimes quite persistent diseases in women and young girls (colpitis, vulvovaginitis, etc) Less frequently trichomonas causes urethritis, prostatitis and other inflammatory diseases in males

Women and girls develop more or less marked leucorrhoea (often foamy), hyperaemia, and slight bleeding of the mucosa, painful urination and itching or burning.

Trichomoniasis in women is often symptomless (subjectively) or with minimum objective signs (or even without them) which presents a special epidemiological danger

Trichomoniasis should be recorded in the pregnancy chart so that necessary measures be taken to prevent contamination of a newborn girl (2-3 drops of a 2% silver nitrate solution on the vulva) Personnel of lying-in hospitals, nurseries, kindergartens, etc, should be examined for trichomoniasis with special care and given the necessary treatment If trichomoniasis is revealed in a girl, her family should be examined

Trichomoniasis in males often resembles chronic gonorrhoea except that a whitish foamy exudate is discharged from the urethra instead of greenish-yellow pus. Whenever trichomoniasis is revealed in a male, his wife (or other partners) should be examined and given proper treatment (even in the absence of clinical signs of the disease).

Trichomoniasis often occurs together with gonorrhoea to complicate the latter and to distort its clinical picture, the disease persists for longer periods.

*Laboratory diagnosis* The material for laboratory examination should be taken into a sterile test tube using a sterile grooved probe or a glass rod. The test tube is placed in warm water and sent immediately to the laboratory. The material is placed in a drop of a warm (37°C) isotonic solution of sodium chloride on a slide. After taking the material from the urethra of the patient, the latter is asked to urinate into a clean glass, the urine is transferred into a test tube, centrifuged and the precipitate studied. The material for examination is taken from newborn girls using a thin glass rod or a pipette which is passed into the vagina.

The material is examined through a microscope (large magnification) and, better, in the dark field of vision. Trichomonas are identified by their jerky movements or convulsive movement of the flagella.

*Treatment* Metronidazole (flagyl, trichopol) are given per os in 0.25 g doses four times a day, the total dose being 5 g.

Osarsol suppositories (or sticks) are given to women with vulvovaginitis after syringing the vagina with a 2% zinc sulphate solution, men are treated locally by daily instillations of 5-10% osarsol suspensions. Otherwise local treatment is the same as in gonorrhoeal infection.

### SOFT CHANCER (CHANCROID)

The causative agent of chancroid are streptobacilli which appear as chains ('fish shoals') in the pus smear. The infection is transmitted during sexual intercourse when streptobacilli penetrate an injured skin or mucosa. The disease has been eradicated in the Soviet Union but its incidence in other countries is rather high.



A bright red spot is formed in 2-3 days after infection, which is transformed later into a nodule and a pustule, which ruptures to form an ulcer. The latter grows quickly to the size of a dime (and over). As a rule, the lesions are numerous and are at various stages of their development. The ulcer has irregular shapes, rough edges, and soft consistency. The bottom is rough and covered with ample pus. The ulcers are very painful, they heal in 2-3 months to leave scars. Phimosis, paraphimosis, gangrene and phagedena may develop in chancroid patients. Inguinal lymph nodes inflame, become purulent, and rupture in 35-40% of patients. The ulcers leave scars on healing.

*Treatment* Sulpha drugs and antibiotics are helpful. White streptocide or norsulphazole (aqueous suspensions) are applied to the ulcers.

### Control of Skin and Venereal Diseases in the USSR

High-skill medical assistance to patients with venereal and contagious skin diseases is free of charge and available to all those who may need it. Medical aid is given at dispensaries due to high efficiency of prophylactic measures taken in the Soviet Union.

Control of venereal and contagious skin diseases is based on the following principles in the Soviet Union.

Every patient with skin and venereal diseases is registered at a hospital. A special form (No 281) is filled in when a venereal or contagious skin disease is revealed in a new patient. The form is sent to a statistical centre where the therapeutic and prophylactic measures are better planned in the country, republic, region, city, or district.

A well-developed network of hospitals (special dermatovenereological hospitals included), many dermatovenereological dispensaries and special posts at polyclinics and rural hospitals ensure prompt and efficacious aid to patients with skin and venereal diseases free of charge. The network of dermatovenereological institutions is governed in its activities by dermatovenereological chairs of medical institutes, research institutes, and institutes of advanced medical skill.

Patients with contagious forms of syphilis are hospitalized

within 24 hours from the moment when the disease has been diagnosed. The first course of treatment is given in stationary conditions.

**Treatment of out-patients** is strictly controlled. Partners of the patients and other persons that may be the *source of infection spread* are revealed and treated as well. Persons that were in close every-day contact with the patient should also be examined thoroughly. According to the Soviet law, any person who evades treatment of contagious forms of venereal diseases shall be persecuted. A visiting nurse performs a very important role in regular examination of patients, revealing sources of infection and persons in contact with the patient. The nurse sends letters to the patients inviting them for treatment or other medical procedures, and visits patients at their homes whenever necessary.

The out-patient system includes *prophylactic examinations* of workers of all children's institutions, children themselves, and workers of food industry. Examination of pregnant women is effective in preventing congenital syphilis.

*Health education* in the Soviet Union is another important factor in control of skin and venereal diseases. It gives the necessary knowledge to population and teaches to consult a doctor and ask for medical assistance in due time and be aware of the danger and harm of late therapy and self-treatment.

There are special prophylactic posts where suspected patients are given treatment to prevent possible infection. The treatment consists in the following:

*Males* are offered to urinate and wash their hands thoroughly with soap. Next, also using warm water and soap, the man should wash his penis, scrotum, pubic region, the thighs and the perineum. The skin is then dried and corrosive sublimate (1 : 4 000) or mercuric oxycyanide (1 : 3 000) rubbed in thoroughly. The anterior portion of the urethra should be washed with 0.5 litre of potassium permanganate solution (1 : 6 000) from Esmarch's irrigator. To prevent syphilis a 33% calomel ointment is rubbed into the genitals. To prevent possible reinfection by the underwear the patient is given a clean piece of gauze to isolate the genitals from the contaminated underwear. The patient is instructed to change his underwear at home.

*Females* also urinate, then have their external genitalia washed thoroughly with warm water and soap, and their vagina syringed with potassium permanganate solution (1 3 000) with subsequent instillation of 1-2% silver nitrate solution into the urethra. A 2 or 3% silver nitrate solution is also used to treat the vaginal mucosa, the cervix, and the external genitalia.

Syphilis is prevented in females in the same way as in males.

The role of a medical nurse in control of venereal and contagious skin diseases is very important. Her role is especially important at posts where she works independently, without guidance of a physician and thus has to take important decisions such as establishing diagnosis, giving first medical aid, and taking measures connected with hospitalization of patients, revealing of the source of infection, and examination of the family.

A medical nurse performs most therapeutic procedures connected with treatment of skin and venereal diseases (injections, instillations, application of pastes and ointments, treatment of mycoses, etc.), takes material for laboratory examination (blood, urine, urethral discharge, fungus-affected hair, scales, etc.), and fills in special statistical forms.

A medical nurse is thus a direct assistant of a physician. She should understand the purpose and sense of all medicinal prescriptions and prophylactic measures. A medical nurse is in a closer contact with the patient and should explain to him the importance of treatment and the necessity of adherence to the prescribed regimen.

The medical nurse should also be aware of the importance of word in the cure of many diseases and also of the harm that an improper word can do to the patient. The medical nurse should remember that her appearance and garments are also very important to the patient, and that his cure in a certain degree depends on her attitude.

### *Answers to Review Questions*

- 1 (1) epidermis, (2) corium or dermis, (3) hypodermis
- 2 Basal layer, spinous layer, granular layer, clear layer, horny layer.

- 3 (2)
- 4 (1), (3), (5)
- 5 (1) long, (2) hair of the eyebrows, eyelids, nose and ear, (3) lanugo
- 6 (1) protective, (2) organ of senses, (3) secretory, (4) excretory, (5) respiratory, (6) thermoregulatory
- 7 About 20 g
- 8 No
- 9 (2), (3), (5), (6)
- 10 (1), (3)
- 11 (2), (3), (5)
- 12 (3), (4), (5)
- 13 (1) nodule, (2) tubercle, (3) node, (4) macula
- 14 (1) vesicle, (2) bulla, (3) pustule
- 15 (1) mechanical action, (2) physical factors, (3) chemical factors, (4) pathogenic microbes, (5) pathogenic fungi, (6) animal parasites, (7) filterable viruses
- 16. (1) disturbances in the nervous system, (2) metabolic disorders, (3) endocrine disturbances, (4) diseases of the internal organs, (5) vitamin dysbalance
- 17. (1) effects on the nervous system, (2) desensitizing action, (3) immunotherapy, (4) vitamin therapy, (5) antibiotic therapy, (6) corticosteroid therapy, (7) sulpha-drug therapy
- 18. (1), (4), (5)
- 19. 30 %
- 20. 50 %
- 21. (1), (3), (6).
- 22 (2), (3)
- 23 (1)
- 24. (1), (4), (5)
- 25 No
- 26 No
- 27 Yes
- 28 No
- 29 No
- 30 (1) squamous, (2) intertriginous, (3) dyshydrotic
- 31 Yes.
- 32 (1) superficial, (2) chronic, (3) zoophilic.
- 33 (2).
- 34 (1).

- 35 (1) in zoophilic microsporia
- 36 (1) scabies, (2) pediculosis
- 37 Yes
- 38 (1) benzyl benzoate emulsion, (2) sulphur ointments, (3) Demianovich's method
- 39 (1) head lice, (2) body lice, (3) crab lice
- 40 (1)
- 41 No
- 42 Yes
- 43 Yes
- 44 40-80 g
- 45 150-200 g
- 46 (1) lepromatous, (2) tuberculoid
- 47 (1) indeterminate, (2) dimorphous.
- 48 (1), (4), (5)
- 49 Yes
- 50 Yes
- 51 No
- 52 (1), (3)
- 53 Yes
- 54 (1) neurodermitis, (2) skin itching, (3) nettle rash, (4) strophulus, (5) prurigo
- 55 Yes
- 56 Yes
- 57 No
- 58 (3)
- 59 (1) progressive, (2) stationary, (3) regressive
- 60 Yes
- 61 No
- 62 (1) incubation, (2) primary, (3) secondary, (4) tertiary
- 63 *Treponema pallidum* (spirochaete)
- 64 (3)
- 65 (1) roscola, (2) papule, (3) pustule.
- 66 No
- 67 Yes
- 68 (1) antibiotics (penicillin, bicillin)
- 69 (1) 40-50 ml
- 70 (1) 16-20 ml

# DISEASES OF THE EAR, NOSE, AND THROAT

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## Chapter 1

### Diseases of the Nose and Paranasal Sinuses

#### ANATOMY OF THE NOSE AND PARANASAL SINUSES

The nose is the anterior part of the upper airways. It comprises the external nose and the nasal cavity with the paranasal sinuses.

The *external nose* consists of the osteocartilaginous framework covered with skin; it has the shape of an irregular trihedral pyramid.

The anatomical parts of the external nose are the tip, the bridge (extending from the root of the nose to its tip), the wings, and the skin of the nasal septum.

The nasal cartilages include the greater and the lesser alar cartilages (Fig. 63). The bony nose comprises the nasal bones, the nasal processes of the frontal bone, and the frontal processes of the maxilla (Fig. 63). The outer edge of the nasal bones, the frontal processes of the maxilla and its palatine processes form the entrance to the nasal cavity, a pear-shaped sinus.

The *nasal cavity* is separated into two symmetrical halves by a partition (septum) which consists of cartilage and bone (Fig. 64). Moreover, the nose has a vestibule. The cartilage of the septum consists of medial pedicles, greater alar cartilages, and vomeronasal cartilage; the bony septum consists of a perpendicular plate of the ethmoid bone and the vomer. The base of the nasal septum is formed by the vertical palatine processes that usually form the crests of the nasal cavity.

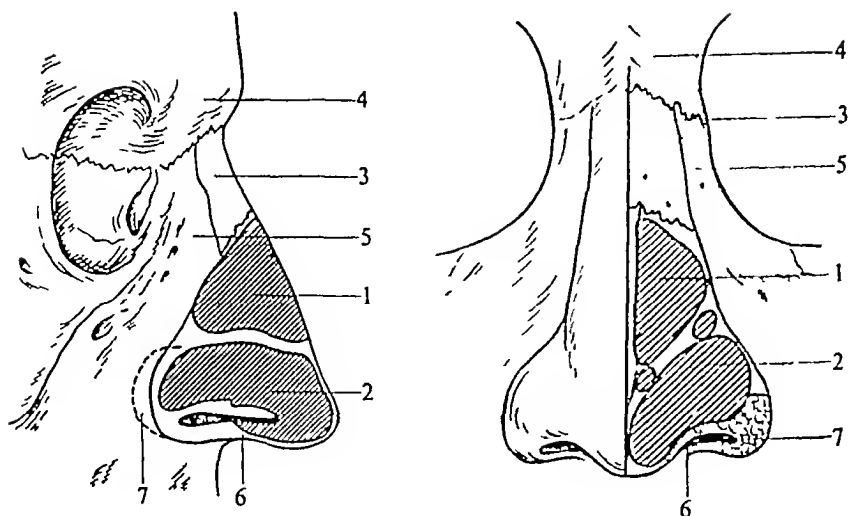


Fig. 63 Bone and cartilage framework of the external nose  
 1—triangular cartilage, 2—greater alar cartilage, 3—nasal bone,  
 4—nasal process of the frontal bone, 5—frontal process of the maxilla,  
 6—entrance to the nasal cavity, 7—lesser alar cartilage

ity The lateral walls of the nasal cavity are bony structures covered with mucosa the inferior, the middle, and the superior turbinated bones (conchae) The inferior, middle and superior nasal passages found between them serve to communicate with the common nasal meatus extending from the nasal vestibule, along the nasal septum, to the nasopharynx (Fig 65)

Openings leading to the frontal and maxillary sinuses, and also the ethmoidal cells are found beneath the middle turbinate bone, the nasolacrimal canal opens into the anterior portion of the inferior concha

The posterior edge of the nasal septum, the vomer, divides it into halves Jacobson's organ and the choanae are seen during examination of the nasal cavity, from the nasal part of the pharynx Choanae are paired openings between the nasal cavity and the nasopharynx through which posterior ends of the inferior and middle conchae are seen The openings of the auditory tubes leading to the middle ear are located laterally to the posterior ends of the inferior conchae,

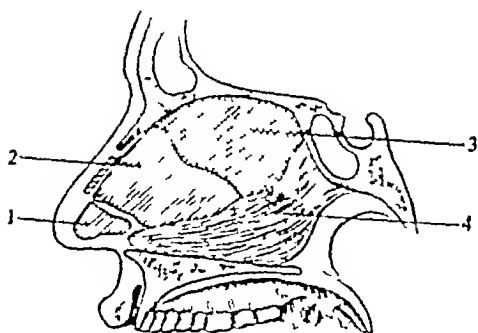


Fig 64 Anatomy of the nasal septum

1—median plate of the greater wing, 2—vomeronasal cartilage, 3—perpendicular plate of the ethmoid bone, 4—vomer (Jacobson's organ)

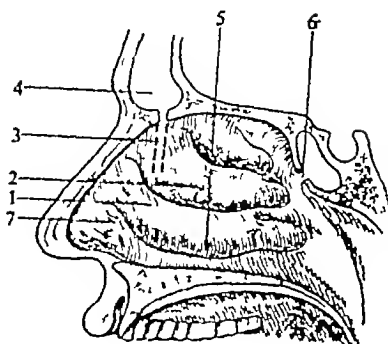


Fig 65 Nasal cavity (lateral wall)

1—inferior turbinate bone (inferior concha), 2—median turbinate bone (middle concha), 3—frontal sinus, 4—frontonasal duct, 5—projection of the outlet opening of the maxillary sinus, 6—outlet opening of the sphenoidal sinus, 7—outlet opening of the nasolacrimal duct

*Paranasal sinuses* are cavities located in the bones of the face (Fig 66, a, b)

*Maxillary (Highmore's) sinus* is a large air cavity in the cranial bone having the shape of a truncated pyramid. Its medial wall is the lateral wall of the nasal cavity, while the upper wall is the bottom of the orbit and the lower wall forms the hard palate, the lateral wall borders with the submaxillary fossa, the anterior wall is the part of the face, it forms the so-called canine fossa. Each maxillary sinus communicates with the nasal cavity through one or several passages that open into the middle meatus below the middle concha.

*The frontal sinus* is an air cavity in the frontal bone (on its either side), its shape resembling a pyramid. Its anterior wall is the medial portion of the frontal bone, the lower wall forms the upper part of the orbit and the anterior parts of the cranial base, the posterior wall is the anterior wall of the frontal parts of the cranium. The frontal sinuses



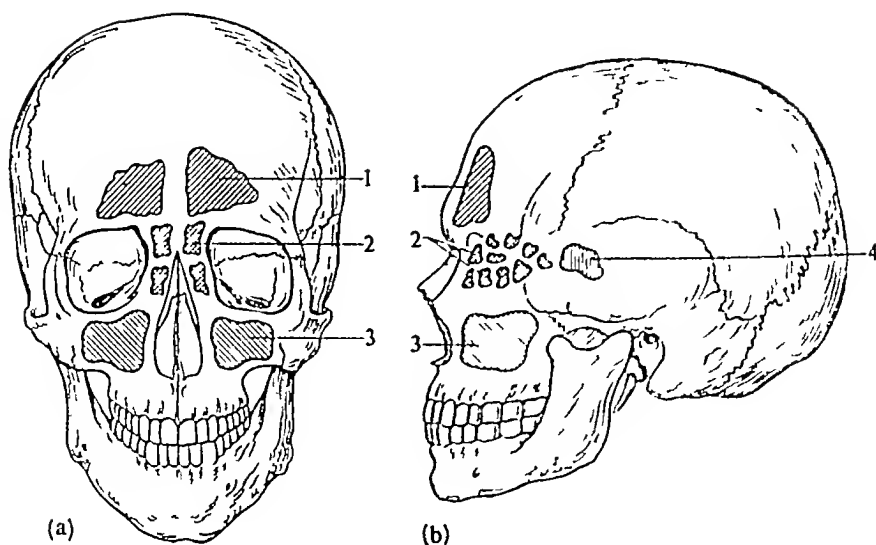


Fig 66 Layout of the paranasal sinuses

1—frontal sinus, 2—ethmoidal labyrinth sinus, 3—maxillary sinus, 4—sphenoidal sinus

are separated from one another by a bony partition and each sinus communicates with the nasal cavity through a frontonasal duct that opens into the middle nasal meatus (see Fig 65). The entire nasal cavity, the sinuses included, is lined with mucosa of ciliated epithelium which helps evacuation of the sinuses' contents through natural orifices.

*Ethmoidal labyrinth* is a system of mucosa-lined intercommunicating cavities with very thin walls. The cavities are situated in the body of the middle turbinate bone and the lateral wall of the nasal cavity. According to their location the ethmoidal labyrinth cavities are classified as anterior, middle, and posterior ones. The anterior and middle cavities border with the maxillary sinus and the medial portions of the orbit, while the posterior cavities with the sphenoidal and frontal sinuses.

The development of the system of the ethmoidal labyrinth is quite variable, in some cases the cavities may compensate for underdeveloped or missing frontal sinuses.

The *sphenoidal sinuses* are paired symmetrical cavities located in the body of the sphenoid bone. The lower part

of the sinus forms a portion of vault of the nasal pharynx. The anterior wall of the sinus has openings communicating each sinus with the nasopharynx. The sinuses are separated from each other by a partition which is continuous with the Jacobson's organ.

The nasal cavity is supplied with blood from the external carotid artery. Complicated venocavernous plexus are located in the mucosa of the inferior and middle conchae. The Kiesselbach area (common site of nosebleed) is located in the anterior portions of the septum mucosa.

### PHYSIOLOGY OF THE NOSE AND PARANASAL SINUSES

The nose and the paranasal sinuses perform several physiological functions such as respiratory, olfactory, protective (a barrier acting as a trap for dust and also as a warmer of the inspired air), resonating, voice- and speech forming, and reflectory, by which the nose is connected with the other organs and systems.

Normal respiration is nasal. The main bulk of the inspired air passes through the middle and upper regions of the nasal cavity. Cavernous veins (cavernous tissues) are located in the mucosa of the middle and inferior conchae. Blood fills them to swell the mucosa and to narrow the nasal passages so that the inspired air, as it passes the nasal cavity, is separated from dust, moistened and warmed up. The ciliated epithelium propels the dust particles towards the nasopharynx. Harmful chemical substances are also retained and partly inactivated by the nasal mucus.

The zone of olfactory epithelium is located in the upper portions of the nasal cavity, in the superior conchae. Nervous fibres pass through the base of the skull to the olfactory centres of the brain.

The nasal mucosa is also rich in receptors which connect the nose with many other organs and systems (in the first instance with the respiratory and the cardiovascular systems) of the human body. Moreover, the paranasal sinuses are involved in the formation of voice and speech (resonating function).

*Review Questions*

- 1 Name the main anatomical structures of the external nose
- 2 Name the bony structures of the external nose
- 3 What cartilages constitute the external nose?
- 4 Name the main anatomical structures of the nasal cavity
- 5 What paranasal sinuses do you know?
- 6 Which of them are paired sinuses?
- 7 Name the functions of the nose and the paranasal sinuses
- 8 Where is the olfactory zone located?

### Examination of the Nasal Cavity

The examination of the nose includes inspection of its external and deeper parts

During external examination the condition of the skin coats, configuration of the bones and cartilages should be examined, and special attention should be given to inspection of the nasal vestibule. Anterior, middle, and posterior rhinoscopy are used for examination of deep parts of the nose

The anterior and middle rhinoscopy comprise direct visualization of the nasal cavity using nasal specula

Posterior (indirect) rhinoscopy is effected with the aid of a nasopharynx speculum after pressing down the tongue root by a spatula (Fig 67)

Direct inspection of the nasopharynx and the region of the choanae becomes only possible after pulling back the

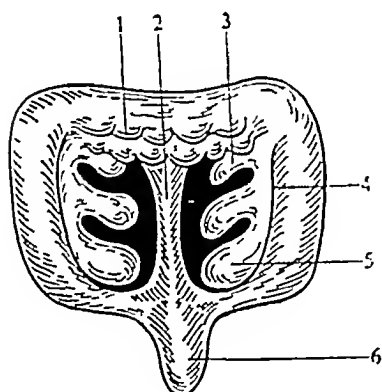


Fig 67 Nasopharynx as viewed in rhinoscopy

- |                            |          |
|----------------------------|----------|
| 1—adenoids,                | 2—vomer, |
| 3—superior turbinate bone, |          |
| 4—middle turbinate bone,   |          |
| 5—inferior turbinate bone, |          |
| 6—uvula                    |          |

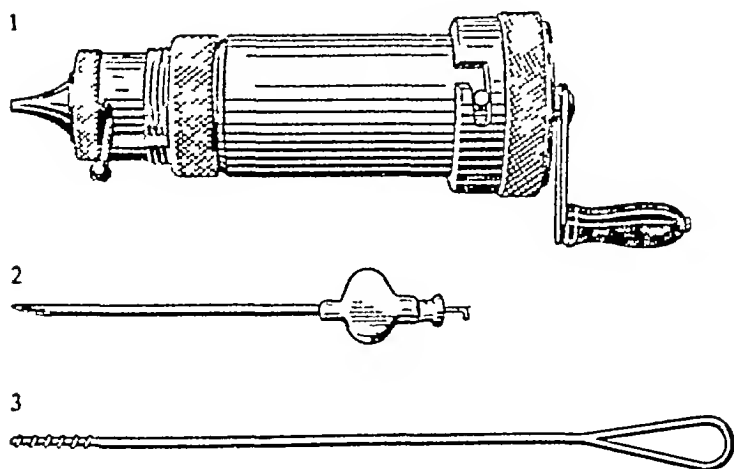


Fig 68 Tools for puncturing sinuses

1—trepan for puncturing the frontal sinus, 2—Kulikovsky's needle for puncturing maxillary sinus, 3—probe for anaesthetizing the nasal cavity

soft palate (with rubber catheters passed through the nasal cavity)

Whenever posterior rhinoscopy is infeasible in children, the nasal portion of the pharynx is palpated

Diagnosis of diseases of the nose and the paranasal sinuses is established by x-ray examination, roentgenography of the paranasal sinuses and the nasopharynx, and contrast roentgenotomography

Moreover, puncturing and probing of the maxillary, frontal and sphenoidal sinuses are used for diagnostic and therapeutic purposes (Fig 68)

### Care and Treatment

The most common manipulations that a hospital nurse has to perform in treating patients with diseases of the nose and the paranasal sinuses are instillation of solutions into the nose and applying ointments. Therapeutic solutions should be instilled into the nose of a lying patient with the head thrown far back and resting on a pillow to prevent flowing of the solution into the lower nasal meatus only

The solution should not be instilled directly into the nasal cavity but onto the upper lateral wall of the nose. From 5 to 6 drops should be instilled into each nostril of adults and 2-3 drops to children.

When *ointments* are given to the patients their position should be the same. The required amount of an ointment should be taken by a glass rod (ophthalmological spatula) and placed into the vestibule of the nose. The ointment melts and is distributed uniformly over the entire nasal mucosa. The patient should stay in the lying position for 20-25 minutes. An important manipulation of a hospital nurse is to suck off mucus or pus by an electric, pneumatic or water-jet pump. This manipulation is especially important in post-operative periods (after anaesthesia, after introduction of a nasoesophageal probe). Methods of treatment and care will be given in more detail later during discussion of particular diseases.

#### FOREIGN BODIES AND INJURIES OF THE NOSE

Foreign bodies of the nose occur mostly in childhood when during their games children would put various objects, such as coins, buttons, beads, etc., into their nose. Foreign bodies are removed from the nose by a physician aided by a rhinoscope, special hooks or nasal forceps. Foreign objects should not be pushed further through the nasal cavity into the nasopharynx since they may be jammed in the nasal passages or inflict serious damage to the thin bony structures separating the nose from the skull, paranasal sinuses and the orbits, moreover, the foreign object may occasionally be aspirated with the air. The routine duty of a medical nurse in this case is to prepare tools that may be required to remove the foreign object, anaesthetizing solutions (2-5% dicaine solution, 5-10% cocaine hydrochloride solution, 2-3% xycaïne), sterile materials (narrow turunda) for drying up blood and for tamponade of the nasal cavity in possible bleeding.

General anaesthesia should be used in infants and hyper-excited older children during removal of foreign bodies from the nose.

Injuries of the nose may be open and closed, with or without displacement of the osteocartilaginous structures. As a rule injuries of the nose are attended with nasal bleeding. Wounds on the skin of the nose should be treated with hydrogen peroxide or other antiseptic solutions. Nasal bleeding may be stopped by pressing the nose wings with the fingers or passing cotton wool or gauze turundae soaked in hydrogen peroxide into the nasal passages. If part of the external nose has been torn off, the separated piece of tissue should be washed thoroughly in sterile isotonic solution of sodium chloride and the patient delivered immediately to the surgical department.

The primary surgical treatment of the injured nose should be done by an otorhinolaryngologist or a traumatologist. A medical nurse should treat the operation field, prepare the necessary tools and sterile material for probing and suturing the wound, correcting the bone fragments (if the nose bones have been injured) and for stopping bleeding.

A frequent complication of nose injuries is also the rupture of blood vessels underlying the septum mucosa, which causes its partial separation (a haematoma is formed). If the haematoma is infected, it may become purulent to fuse the septum cartilage and cause deformation (sinking) of the nose bridge. Haematomas of the septum should be opened by an otorhinolaryngologist during direct rhinoscopy with subsequent drainage during the next few days.

If the injury of the nose attended with displacement of the cartilage and bone fragments is not corrected in due time permanent deformation of the external nose occurs with a marked cosmetic defect, or the septum may be disfigured to cause dysfunction of the nose. Special surgical treatment in stationary conditions will then be required.

### ACUTE AND CHRONIC RHINITIS OZAENA

*Acute rhinitis* is as a rule a manifestation of an acute respiratory disease or influenza, but it can sometimes be an independent disease. Rhinitis is often a symptom of infectious diseases of children, such as pertussis, measles, scarlet fever, epidemic (infectious) parotitis, etc.

Acute rhinitis begins with itching and dryness in the nose and attacks of sneezing. The nasal mucosa reddens and swells. On the second day of the disease ample mucus is discharged from the nose and the respiration becomes impeded because of the swollen mucosa. The mucosa of the nasolacrimal duct becomes swollen as well and the ducts narrow to increase lacrimation and erythema of the conjunctiva. The nasal discharge may later become purulent, and crusts may be formed on the nasal mucosa. If rhinitis recurs at short intervals and in the presence of other pathologies in the nasal cavity and/or paranasal sinuses, acute rhinitis may convert into chronic catarrhal rhinitis.

The assisting duties of a nurse in acute rhinitis are as a rule simple and consist in care of the nose of children and asthenic (grave) patients in order to preclude irritation of the skin round the nose. In compliance with the doctor's instructions the nurse should insufflate powdered medicines and instill 3 % ephedrine hydrochloride solution with adrenaline, naphthyzine (sanorine), etc., into the nasal cavity, she should also administer ointments (locacorten, streptocide, synthomycin, or composite ointment) into the nose. Using cotton wool wicks the nurse should perform sanitation of the nasal passages in children. Solution containing menthol or cocaine should not be instilled to infants under 3 years of age.

Acute rhinitis can also be caused by irritating chemicals, inhalation of dust, or by some allergens.

*Chronic rhinites* are divided into catarrhal, hypertrophic, atrophic, vasomotor and allergic. *Chronic catarrhal rhinitis* should be treated with astringent drops 3-5 % protargol or collargol solution, 5-6 drops into each nostril, 3-4 times a day, the nasal mucosa should be treated with 5-10 % silver nitrate solution twice a week (4-5 procedures per course), physiotherapy (microwaves, phonophoresis with potassium iodide, UHF radiation, quartz lamp) should also be used.

*Chronic hypertrophic rhinitis* is characterized by periodical or continuous nasal obstruction, impeded nasal respiration, mucous or mucopurulent discharge from the nose and the nasopharynx. These symptoms may be supplemented with complaints associated with impeded nasal respiration, fa-

tigue, decreased work capacity, headaches, pains in the nasopharynx and the pharynx

Anterior and middle rhinoscopy reveals congestive hyperaemia of the nasal mucosa and its thickening. As a rule, true hypertrophy of the mucosa of the inferior and middle conchae is observed, pleats of the hypertrophic mucosa hang down and partly or completely obturate the middle and the lower nasal meatuses. Hypertrophy of the mucosa in the anterior and posterior ends of the inferior (less frequently of the middle) conchae is more pronounced. Posterior rhinoscopy reveals considerable obstruction of the choanae by dark-cherry or cyanotic (with irregular and often granular surface) posterior ends of the inferior turbinate bones.

True hypertrophy of the mucosa should be differentiated from oedema (swelling), i.e. false hypertrophy. To that end the mucosa is treated with adrenaline-cocaine solution. In false hypertrophy the mucosa contracts completely to give access for inspection of the main structures of the nasal cavity, in true hypertrophy, hypertrophic soft-tissue formations protrude distinctly and hang into the lumen of the nasal cavity. The acuity of olfaction is often impaired in hypertrophic rhinitis.

*Treatment* of early stages of hypertrophic rhinitis consists in prolonged use of astringent drops (1-2% protargol and collargol, zinc or bismuth ointments, 2-10% silver nitrate solution).

Pronounced forms of hypertrophic rhinitis are treated surgically. The treatment consists in galvanocautery of the inferior and middle conchae (usually in out-patient conditions).

A medical nurse prepares tools required for examination of the nose: a special transformer, a set of galvanocautery tools, anaesthetizing solutions, and other tools and materials for nasal tamponade. To prevent formation of synechia between the nasal septum and the turbinate bones, it is necessary to instill vasoconstrictive preparations into the nose 5-6 times a day during 5-7 days.

Resection of hypertrophic regions of the inferior and middle conchae and posterior ends of the inferior turbinate bones is another surgical method of treating hypertrophic rhinitis. The resection of the turbinate bones is done with



special scissors, while their posterior ends are removed by a wire loop passed through the nose

Surgical interventions in the nose are often attended with strong bleeding, and the nurse should therefore prepare all necessary means for anterior and posterior tamponade of the nasal cavity (for details see 'Nasal Bleeding')

At the end of the operation, anterior or posterior tamponade with streptocide or other antiseptic ointment is indicated. The tampons should be renewed or removed completely not later than in 48 hours after the operation. It is not recommended to leave the tampons without their renewal for more than 48 hours in posterior tamponade because the tampons get infected and cause complications (acute otitis).

*Chronic atrophic rhinitis* is manifested by dryness in the nose and the nasopharynx, retention in the nose and the nasopharynx of thick, often pyogenic, mucus and formation of dry crusts in the nasal passages. Rhinoscopy reveals pallid atrophic opaque mucosa and crusts with thick mucus in the nasal passages. Despite objective absence of constriction in the nasal passages, patients complain of impeded nasal respiration. The olfactory function becomes deteriorated. The cause of this disorder is prolonged exposure to dry and heavily dust-laden air, irritating and harmful chemical substances in high concentration. Congenital susceptibility to subatrophy of mucosa is also important.

*Treatment* is often very difficult and requires time, patience, and persistence since subatrophic processes are not limited to the nasal cavity but are extended onto the posterior wall of the pharynx and sometimes larynx (subatrophic rhinopharyngolaryngitis).

Oil drops (vitamin A in oil solution) are usually used along with alkali-oil inhalations, alkaline and alkali-oil nasal douches. Procaine blocks with aloe (2-3 ml are injected by a syringe two times a week into the lateral pharyngeal tori) are often effective in nasopharyngitis. Vitamin therapy and biogenic stimulants (aloe, etc.) are used along with local treatment.

*Ozaena* is an infectious trophic disease manifesting in atrophy of the mucosa and (in grave cases) bony nose, with formation of ample dirty-green offensive-smelling crusts. The odour is so objectionable and pronounced that the ozaena

patients are unbearable in community and personal contact. Thus the disease becomes the source of physical and moral sufferings.

Conservative *treatment* of ozaena includes massive administration of antibiotics acting on the gram-negative flora, oil drops of vitamin A, and synthomycin emulsion into the nose, and physiotherapy oil inhalations, electrophoresis with potassium iodide, galvanic collar (after Shcherbak) and mechanical treatment of the nasal cavity with various deodorants, applying Lugol's solution to the nasal mucosa and the nasopharynx, placing tampons with chlorophyllocarotin paste which effectively destroys offensive odour of the crusts.

In untreated cases, where the atrophy of the bony nose is marked, surgical treatment is indicated after anaesthetizing the patient, homo- or autocartilage or bone plates are introduced under the mucosa of the nasal cavity bottom and the nasal septum. Transplanted tissue narrows the nasal passages to cause permanent irritation of the nasal mucosa. The symptoms of the disease are thus relieved or removed.

### NASAL BLEEDING

Causes of nosebleed may be local, associated with pathology of the nose and paranasal sinuses, and general, due to diseases of other organs and systems. Local causes are direct injuries of the nose due to accidents or surgical interventions, dilation of the vessels in the anterior portions of the septum and tumours of the nose. Causes of the general character are hypertension (associated with athero- and arteriosclerosis), diseases of blood, haemophilia, Osler's disease, diseases of the kidneys, etc.

Nosebleed may amount from a few drops to several litres. Depending on the cause, localization, and the intensity of bleeding, various methods are used to control it.

*Treatment* An effective method to stop nosebleed from anterior portions of the nasal cavity is pressing the wings of the nose to the septum for 3-10 minutes. Cold compress on the nose bridge is another effective method. Dorsal elevated position of the patient with the head bent forward facilitates control of nose bleeding. If it fails, tamponade of

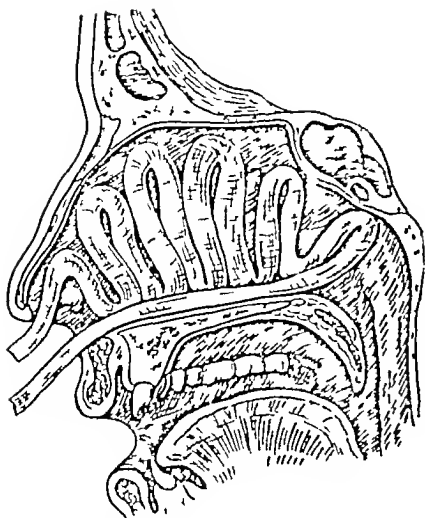


Fig 69 Complete tamponade of the nasal cavity

the nose with cotton wool should be used. A tampon (5-8 cm long and 1.5-2 cm thick) should be soaked in hydrogen peroxide and used to pack the nasal cavity by forceps. In addition to local manipulations, the physician may prescribe general haemostatic preparations (vikasol, vitamins K, C and P, aminocaproic acid).

A radical haemostatic method is tamponade of the nasal cavity. Anterior, posterior and total tamponades are distinguished.

Tamponade of the nasal cavity is performed by a physician but anterior tamponade can in some cases be done by a nurse.

*Anterior tamponade* is performed by an otorhinolaryngologist under visual control. A gauze tampon (1 cm wide), soaked in hydrogen peroxide, Vasilyeva's paste or other medicinal preparations, is used to pack the nasal cavity (Fig 69).

*Posterior tamponade* is used in cases where the anterior tamponade fails to stop bleeding from the middle and posterior regions of the nose. Posterior tamponade is performed by an otorhinolaryngologist simultaneously with anterior tamponade. After giving local anaesthesia of the nose, nasopharynx and oropharynx by dicaine (cocaine), a thin rubber catheter is passed through the nasal cavity into the nasopharynx and further into the mouth (Fig 70, a). The tampon is prepared as follows: cotton wool is wrapped in a piece of gauze to form a cushion (the size of the first phalanx of the thumb) and tied up with a 25-35 cm long thick silk thread having three ends. Two ends are tied up to the end of the rubber catheter passed through the nose and the catheter is pulled back through the nose (Fig 70, b). Aided by the finger, the tampon is pushed under the soft palate into the

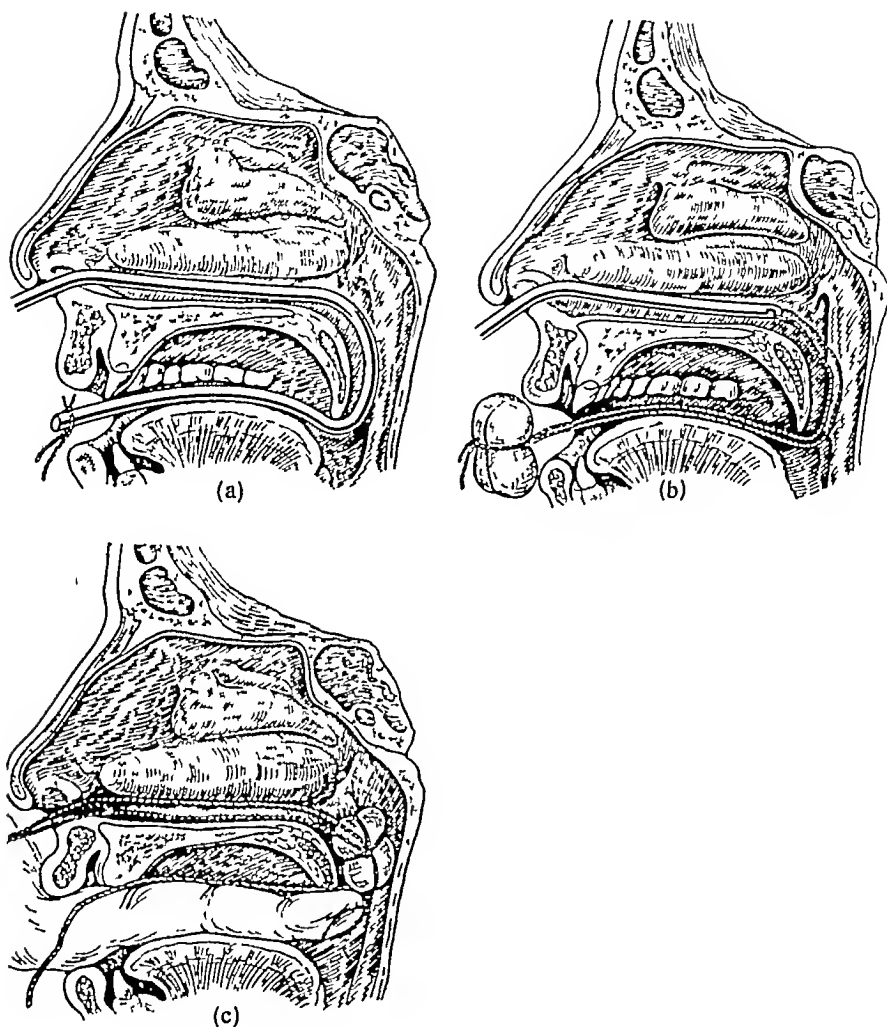


Fig 70 Posterior tamponade (Bellocq)

*a*—passing a rubber catheter through the nasal cavity into the nasopharynx (1st step), *b*—passing the tampon by a silk thread and a catheter through the mouth into the nasopharynx (2nd step), *c*—packing the nasopharynx by the tampon (3rd step)

nasopharynx. The third end of the silk thread remains in the mouth while its free end is fixed on the cheek by an adhesive tape (Fig 70, *c*). Anterior tamponade is then performed

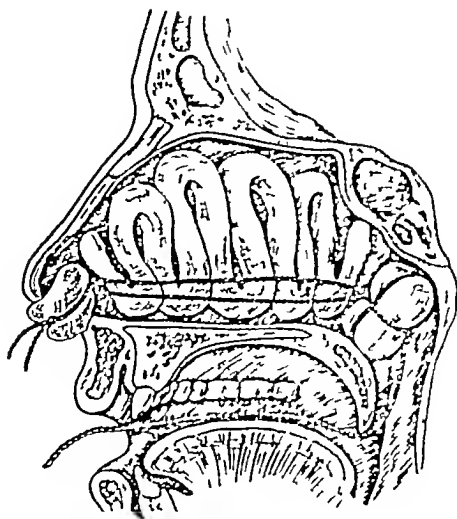


Fig 71 Posterior tamponade (Bellocq) with additional tamponade of the nose

under visual control. The two other threads passed through the nose are tied up on the tampon (Fig 71).

A four-tailed bandage is placed by a nurse on the nose after each tamponade. When the tampons are removed they often require preliminary moistening, which is done by instillation of hydrogen peroxide solution.

Patients with frequent relapses of nasal bleeding require transfusion of blood of the same group.

In cases where nasal bleeding is caused by a general disease, the patient should also be given a course of therapy for the main disease (hypertension, haemophilia, diseases of the kidneys, etc.).

### ACUTE AND CHRONIC SINUITIS

Frequently occurring diseases of the accessory sinuses are acute and chronic inflammations of the paranasal sinuses: rhinosinusitis, ethmoiditis, frontitis and sphenoiditis. One sinus is affected in rare cases, several neighbouring sinuses are involved as a rule. If all sinuses on one side are affected, the disease is called hemipansinusitis, and if all sinuses of

both sides are involved, the process is known as pansinusitis

*Acute inflammation* of the paranasal sinuses manifests in rhinitis with ample mucopurulent nasal discharge, headache, heaviness in the head, elevated body temperature. Acute sinusitis is often preceded by influenza or acute respiratory disease. Objectively the disease is characterized by pains during palpation of the anterior wall of the affected sinus, the canine fossa (in highmoritis), lateral slope of the external nose (in ethmoiditis) and anteroinferior wall of the forehead above the orbit (in frontitis). Anterior rhinoscopy reveals hyperaemic and oedematous nasal mucosa, in the inferior conchae in particular, a stream of pus or mucopurulent discharge is seen in the middle nasal meatus. In some cases, where the first and second branches of the trigeminal nerve (which are adjacent to the sinus) are involved in the process, trigeminal pains appear and irradiate into the upper teeth, pharynx, soft tissues of the face and into the frontoparietal and temporal regions. Diagnosis of acute sinusitis is confirmed by roentgenography of the paranasal sinuses. x-ray patterns show darkened spots in one or several inflamed sinuses.

*Treatment* of acute sinusitis is normally conservative. Vasoconstrictive preparations are prescribed 3% ephedrine hydrochloride with adrenaline hydrochloride solution, naphthyzine (sanorine), 5-6 drops into both sides of the nose, 5-6 times a day. This promotes dilation of natural openings in the sinuses and adequate outflow of the exudate and pus from the sinuses. To reduce general intoxication and to ensure the antimicrobial effect, the patient is given antibiotics and sulpha drugs. In the absence of contraindications, the therapy is supplemented with physiotherapy. UHF rays or microwaves, sollux, five or six 6-10 minutes sessions on the affected sinus. Warmth is also indicated (hot sand, poultice). If an x-ray pattern shows total darkening of the maxillary sinuses, a diagnostic puncture is required.

Recurrent sinusitis, the presence in the nose and paranasal sinuses of additional pathology (chronic hypertrophic rhinitis, polyps, deformation of the septum, deep caries of teeth) may cause conversion of acute sinusitis into its chronic form. Three main forms of *chronic sinusitis* are distinguished: catarrhal, purulent, and polypous. Like in acute sinusitis,

several sinuses would be usually affected most frequently Highmore's (maxillary) sinuses and the ethmoidal labyrinth of one side, less frequently the ethmoidal labyrinth and the frontal sinus, and still less frequently the sphenoidal sinus

Chronic sinusitis is characterized by the following clinical picture persistent rhinitis, nasal obstruction, impeded or absent nasal respiration through the affected half of the nose, permanent or intermittent (during exacerbation) significant purulent or mucopurulent discharge, constant heaviness in the head and headache, considerable decrease or complete loss of olfactory function When chronic sinusitis is exacerbated the soft tissues of the cheeks often become swollen, the eyelids and/or soft tissues of the orbit may also get swollen in highmoritis, ethmoiditis and frontitis

*Treatment* of chronic sinusitis is both conservative and surgical (the latter may be effected in hospital and out-patient conditions)

Local use of vasoconstrictive drugs (drops or ointments) is obligatory but often insufficient to remove pus from the maxillary and frontal sinuses The maxillary, frontal and sphenoidal sinuses are therefore punctured regularly to suck off their purulent contents, wash them with antiseptic solutions, and to administer antibiotics (in accordance with individual sensitivity of the patient) If the purulent process is not stopped by one or two punctures, a thin polythene tube is inserted into the sinus through the puncture needle and is used for daily lavage of the sinus and administration of medicinal preparations into the sinus during the entire term of treatment

Antibiotics and sulpha drugs are used to remove general intoxication and to preclude possible complications

The complex therapy includes warmth and electric procedures alkali and oil inhalations, UHF waves, microwaves (10-12 sessions per course), electrophoresis with antibiotics, calcium chloride, etc., ultrasound (10 procedures, induction therapy with vortex current electrode)

In the absence or insufficient effect of conservative therapy the patient should be treated surgically To restore nasal breathing and to ensure drainage of the sinuses, the polyps are removed from the nasal cavity (polypotomy),

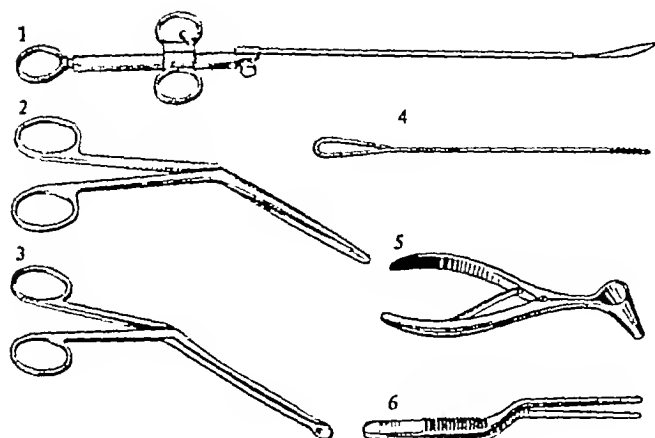


Fig 72 Polypotomy tools

1—nasal loop, 2—packer, 3—fenestrated nasal forceps, 4—probe for anaesthesia, 5—nasal speculum, 6—nasal forceps

the ethmoidal cells are opened to remove polyps and pus (Fig 72)

*Surgical treatment* of chronic sinusitis consists in endonasal and extranasal opening of the affected sinus, removal of its pathological contents, and formation of permanent communication between the sinus and the nasal cavity (high-morotomy—opening of the maxillary sinuses, frontotomy—opening of the frontal sinus, sphenotomy—opening of the sphenoidal sinus)

Acute and chronic purulent sinuites may cause various complications if treated inactively or improperly. The complications include abscesses of the brain and the cerebellum, extradural abscesses, meningitis, arachnoiditis, thrombosis of the venous sinuses of the cranium and the brain.

In addition to intracranial complications, the following may also occur: phlegmona of the orbit, fistulae into the mouth through the cavity formed after extirpation of a tooth, trigeminal neuralgia, etc.

The main method to prevent and treat complications is timely surgical intervention.



## FURUNCLE OF THE NOSE

The first symptom of furuncle of the nose is itching in the vestibule of the nose or its tip. It is followed by swelling, hyperaemia, and induration of the skin of the nose tip or base. The general condition of the patient also worsens during development of the furuncle and the body temperature rises to 38-39°C. The patient complains of sharp pain in the nose and headache.

A medical nurse should remember herself and explain to her patients the harm and danger of expressing pus from the furuncle or a simple pyogenic pimple on the nose or its vestibule, because the external nose and the nasal cavity are richly supplied with blood and lymph vessels that are widely anastomosed with the intracranial vessels, severe intracranial complications therefore are possible. abscesses of the brain, thrombosis of the cavernous sinus, meningitis, and sepsis.

Patients with furuncles of the nose should be treated in hospital conditions. A hospital nurse should fulfill prescriptions of the physician: intramuscular injections of antibiotics and analgetics, renewal of four-tailed bandages, tampons with neutral or antiseptic ointments which are placed inside the nose if the furuncle opens inside the nose, physiotherapeutic procedures such as UHF rays, microwaves, and quartz and sollux lamps during the resolving stage.

Furuncles of the nose are treated conservatively but if deep purulent processes develop, surgery is required.

*Review Questions*

- 9 How is the nasopharynx examined in children?
- 10 What is the correct method to instill drops? (1) in the sitting position, (2) in the standing position, (3) in the dorsal position.
- 11 Can a foreign body be removed by pushing it further into the nasopharynx?
- 12 How are chronic rhinites classified?
- 13 What are the methods to stop nosebleed?
- 14 What forms of chronic sinusitis do you know?
- 15 What grave complications may be caused by acute and chronic sinusitis?

- 16 What operations on the nose may be performed at a polyclinic?
17. Can a furuncle of the nose be expressed?

## SURGICAL TREATMENT OF PATIENTS WITH DISEASES OF THE NOSE AND PARANASAL SINUSES

### Preoperative and Postoperative Treatment

Preoperative treatment of patients is very important to ensure effective surgery. This is the prerogative of a medical nurse. Operations on the nose, the nasal cavity, and the paranasal sinuses should be done with local or general anaesthesia.

A medical nurse should see to it that a patient should take a bath on the day (or two days) before the operation, in urgent cases, the patient should undergo special sanitary treatment immediately before the operation.

The medical nurse should see to it that a patient prepared for an operation in out-patient conditions should have his case history, the results of the preoperative analyses and examinations, such as total blood and urine analysis, test for haemorrhagic syndrome, thrombocyte count, erythrocyte sedimentation rate, roentgenoscopy of the chest, and the conclusion of an internist on the absence of contraindications to the operation. Patients over 60, and those with cardiovascular pathology and cardiopulmonary insufficiency should have their ECG.

Whenever necessary, the physician may require some other examinations: roentgenography and tomography of paranasal sinuses, conclusion of an anaesthesiologist, etc.

The following operations can be done in polyclinic (out-patient) conditions: submucous resection of the nasal septum, conchotomy (anterior and posterior), polypotomy, opening of the ethmoidal labyrinth, biopsy from the nose.

If, however, the condition of the patient does not permit, these operations should be performed in stationary conditions.

All these operations (except submucous resection of the septum) may be performed with local anaesthesia by applying

5-10% cocaine solution, 1-3% dicaine or xylocaine (with adrenaline hydrochloride) solution to the nasal mucosa. The anaesthetizing solutions should be sterile (as well as all other materials and tools, irrespective of the fact whether the operation is performed in ambulatory or hospital conditions).

The duties of a scrub nurse are to prepare the necessary solutions, and to supervise over sterility of the solutions, various materials and tools.

During the preparation for an operation and during the operation proper, the nurse should be at the side of the patient.

When prescribed by the physician, the nurse gives the patient sedatives, hypnotic and anti-allergic preparations (dimedrol, suprastin, etc.) on the night before the operation, takes his body temperature, watches the patient during his sleep, gives the necessary medicines in the morning, supervises his defaecation and urination, and watches his behaviour.

After submucous resection of the nasal septum, polypotomy, conchotomy, incision of the ethmoidal labyrinth and sometimes after biopsy, anterior tamponade of the nose is used (see 'Nasal Bleeding'). The tampons may stay in the nose for 24-48 hours after which term they should be removed. This may cause recurrent bleeding and the nurse should therefore get prepared to stop it using the necessary sterile materials and tools. After termination of the operation and tamponade of the nose, a four-tailed bandage is placed (with an insert of cotton wool). The nurse should accompany the patient to his ward and place him in bed or (in out-patient conditions) watch the state of the patient for 60-90 minutes in a special room. In all cases, after the removal of the tampons, vasoconstrictive preparations and oil drops should be instilled into the nose for 5-7 days to preclude formation of cicatrices on the mucosa (synechia).

During surgical treatment of chronic sinusitis, the maxillary, frontal or sphenoidal sinuses are incised and a wide artificial passage is made to communicate them with the nasal cavity. Rubber or polythene tubes are inserted into these passages for a few days after operation to ensure drainage of the sinuses and administration of medicinal prepara-

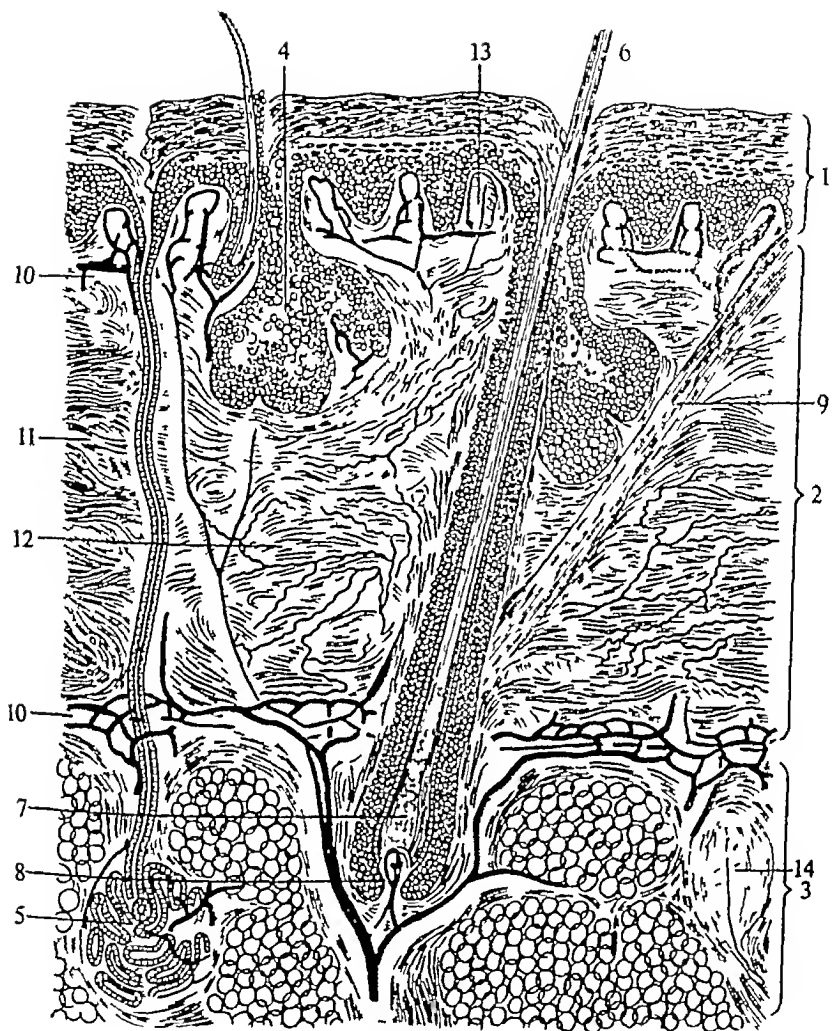


Plate 1 The structure of the skin (after A I Kartamyshev)  
 1—epidermis, 2—dermis (corium), 3—subcutaneous connective tissue (fat), 4—sebaceous gland, 5—sweat gland, 6—hair, 7—hair bulb, 8—hair papilla, 9—arrector muscle of hair, 10—blood vessels, 11—collagen fibres, 12—elastic fibres, 13—Meissner's corpuscle, 14—Vater-Pacini corpuscle

Plate 2 Syphilitic roseola



Plate 3 Lenticular syphilitic papules

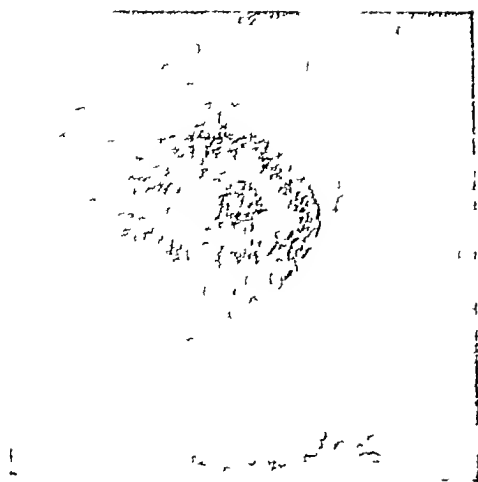


Plate 4 Eroded papules on the tongue

Plate 5 Mosaic scar left by tubercular syphilid



Plate 6 Gumma of the mandible

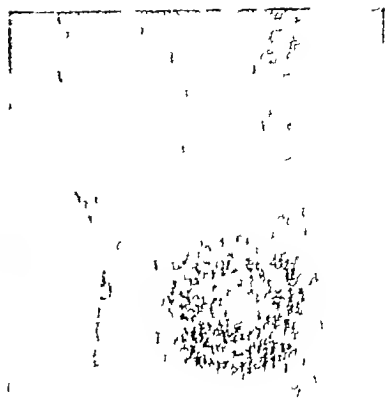


Plate 7 Gummatous ulcer



Plate 8 Diffuse syphilitic infiltration of the skin



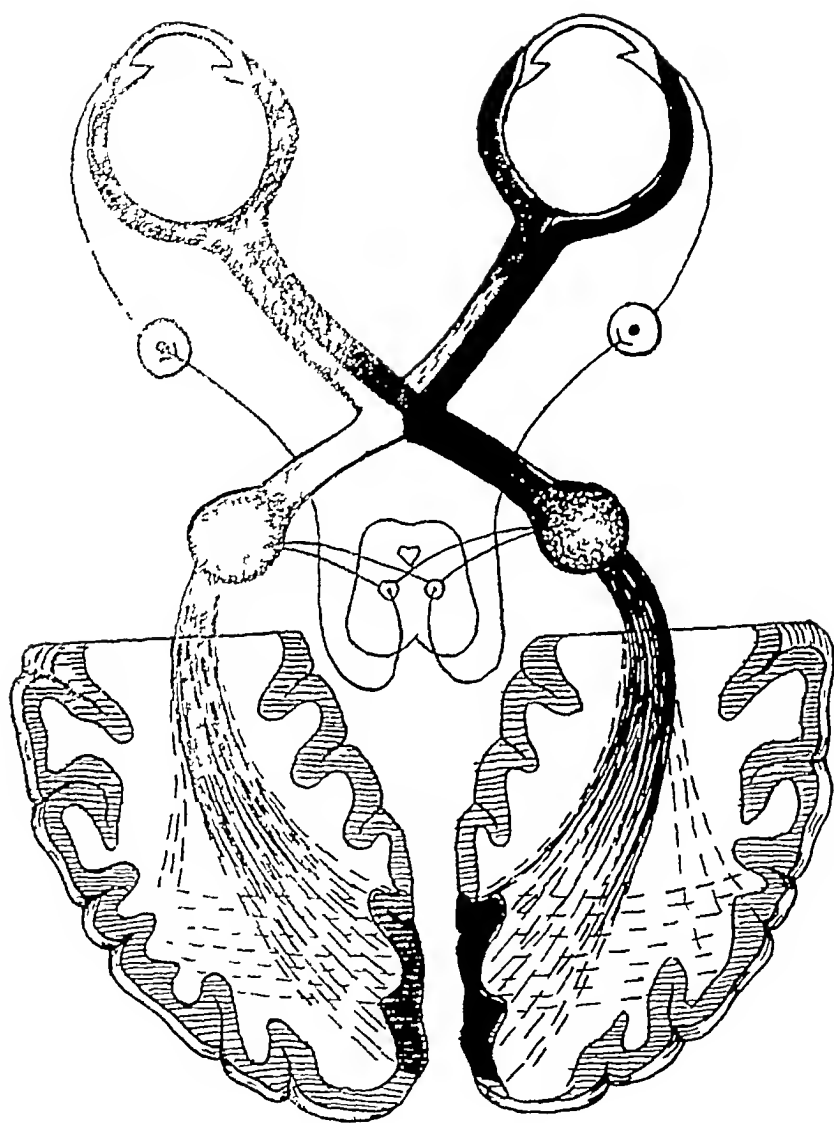


Plate 9 Optic routes

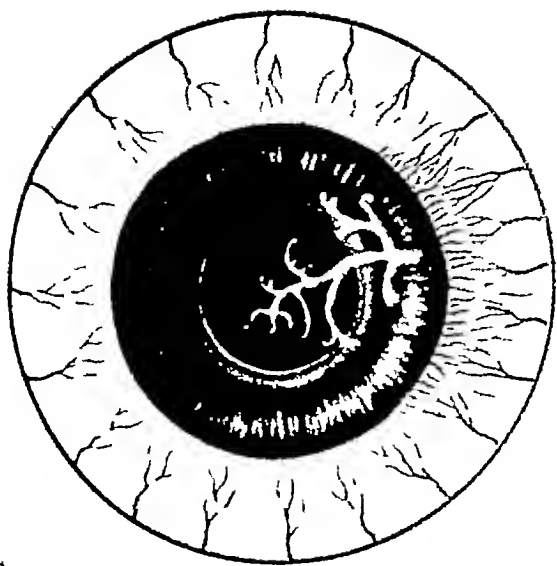


Plate 10 Dendritic keratitis

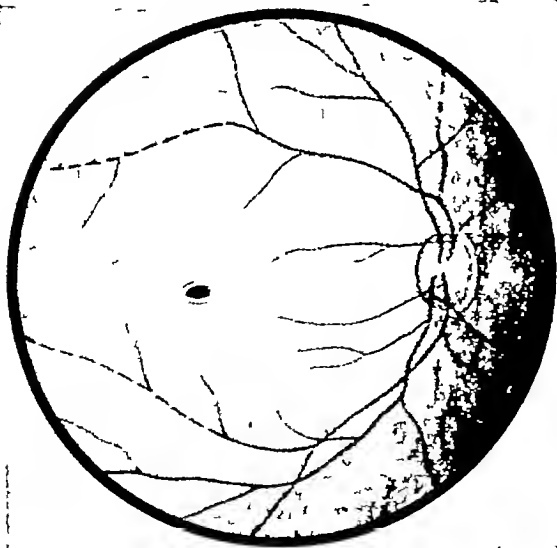


Plate 11 Obstruction of the central retinal artery

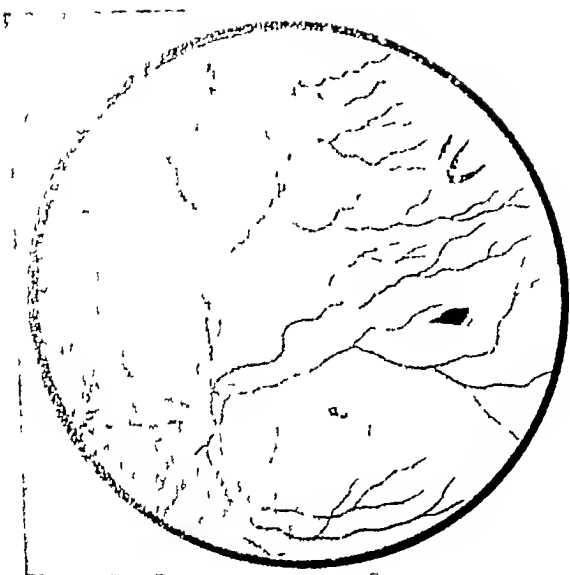


Plate 12 Detachment of the retina

tions into them. The nurse (under control and supervision of a physician) washes the operated sinuses during the post-operative period and administers medicines into them. If a rubber or polythene tube is inserted into the sinus, pathological contents are first removed from the sinus using an ordinary syringe, and the sinus is then rinsed with an antiseptic solution (furacin, potassium permanganate, etc.). The sinus contents are then sucked off again and antibiotics, enzymes, and other medicinal preparations (as prescribed by the physician) should be administered into the sinus. During the lavage of the sinus the patient should assume a position over a basin with his head bent down, the mouth open, and the tongue protruded from the mouth cavity so that the washing liquid should not be aspirated but freely flow down into the basin. There is a special device intended for lavage of the paranasal sinuses through their natural and operationally widened passages. This consists of a metal catheter, a rubber adapter tube, and a Janet syringe (Fig 73). The patient is anaesthetized, and the physician (under visual control) inserts the catheter into the sinus through the anastomosis, the nurse presses carefully on the syringe piston to express the fluid and to wash the sinus with a warmed up antiseptic solution.

Purulent acute and chronic sinusitis may cause severe complications. As has already been said, the blood vessels of the nose and the paranasal sinuses anastomose with the circulating system of the cranium. If the suppurative process destroys the wall of the frontal sinus or the infection is transmitted with the blood or lymph into the cranium, purulent meningitis, abscess of the brain, and thrombosis of the cerebral venous sinuses may occur.

A commonly used surgical operation is also correction of the external (osteocartilaginous) framework of the nose after its injuries (humpback or sunk bridge, disfiguring of the bones or cartilage of the external nose).

Surgical correction is made in hospital conditions, as a rule with general anaesthesia.

In cases with sunk bridge, the correction is done through special cosmetic incisions of the skin through which bone, cartilage or plastic transplants are inserted. Humpback nose is also corrected by removing surplus tissue through

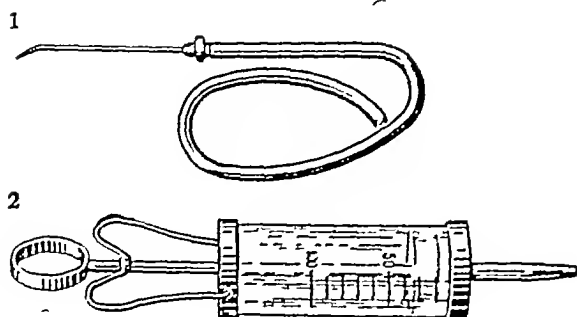


Fig 73 Tools for irrigation of the maxillary sinus  
1—metallic catheter with a rubber tube, 2—Janet syringe

cosmetic incisions. Complicated deformations of the nose require total osteotomy (i.e. surgical correction of all nasal bones) and subsequent immobilizing bandage.

Care of patients after removal of tumour from the nasal cavity is difficult because this surgical intervention is very injurious and is attended with considerable loss of blood (large volumes of tissues are removed). During the first postoperative days, the patient should keep bed and take semiliquid cool food. The nurse should keep watch of the patient condition, his physiological functions, and timely renew four-tailed and other bandages. Removal of tampons from the nasal cavity is fraught with danger of strong bleeding and should therefore be done by a physician.

Pre- and postoperative treatment and care of patients with diseases of the nose and paranasal sinuses are thus very important, and their efficacy greatly depends on proper performance by the nurse of her duties.

#### *Answers to Review Questions*

- 1 The root of the nose, its bridge, tip, and wings
- 2 Bones of the nose, frontal processes of the maxilla, and nasal processes of the frontal bone
- 3 Triangular, greater and lesser alar cartilages
- 4 Nasal septum, inferior, middle, and superior conchae (turbinates)
- 5 Maxillary (Highmore's), ethmoidal, frontal, and sphenoidal.

- 6 All of them
- 7 Respiratory, olfactory, protective (dust trapping and air warming), resonating, voice and speech forming, reflectory.
- 8 On the superior turbinate bones and in the vault of the nasal cavity
- 9 By palpation of nasopharynx
- 10 (3).
- 11 No.
- 12 Catarrhal, hypertrophic, atrophic, vasomotor, and allergic
- 13 Pressing the wings to the nasal septum, anterior and  
| posterior tamponade
14. Catarrhal, purulent, and polypous
15. Phlegmona of the orbit, abscesses of the brain and the cerebellum, extradural abscesses, meningitis, arachnoiditis, thrombosis of venous sinuses of the cranium and the brain
16. Submucous resection of the nasal septum, resection of the conchae, polypotomy, incision of the ethmoidal labyrinth, biopsy of the nose
17. No

## Chapter 2

# Diseases of the Pharynx

### ANATOMY OF THE PHARYNX

The throat (pharynx) is a funnel-shaped structure, whose upper wide part begins from the choanae and ends at the entrance to the oesophagus. The pharynx is divided into three parts: the nasopharynx, oropharynx, and laryngopharynx.

The *nasopharynx* is limited anteriorly by the entrance to the choanae, and superiorly and posteriorly by the vault of the nasopharynx. The auditory tubes open on the lateral wall of the nasopharynx, posteriorly to the ends of the inferior conchae. The so-called third (pharyngeal) tonsil is located in the vault of the nasopharynx, above the upper edge of the Jacobson's organ.

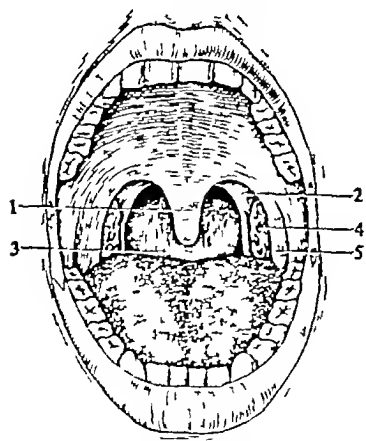


Fig 74 Oropharynx

1—uvula, 2—palatopharyngeal arch, 3—posterior pharyngeal wall, 4—palatine tonsil, 5—palatoglossal arch

The nasopharynx is separated from the *oropharynx* (Fig 74) by the posterior edge of the hard palate. Anteriorly the oropharynx opens into the mouth through the *fauces*, the upper part of which is limited superiorly by the soft palate, inferiorly by the root of the tongue, and laterally by the palatoglossal arches. Almond-shaped masses of lymphoid tissue, known as palatine tonsils, are located between the palatoglossal and the palatopharyngeal arches.

The *laryngopharynx* is limited anteriorly by the tongue

root and the entrance to the larynx, and inferiorly and posteriorly it is continuous with the epiglottis and oesophagus. The fourth, or lingual tonsil, is located on the root of the tongue. All four tonsils form a throat ring (the Waldeyer-Pirogov tonsillar ring).

Accumulations of lymphoid tissue in the form of plaques are found in varying quantities on the mucosa of the posterior wall of the pharynx.

Soft tissues adjacent to the lateral walls of the pharynx invest main blood vessels of the neck (the cervical vasonervous bundle), namely, the inner jugular vein, the common, inner and other carotid arteries, and the vagus nerve. The mucosa is underlain by the layer of muscles consisting of the inferior, middle, and the superior pharyngeal constrictors that propel food through the pharynx.

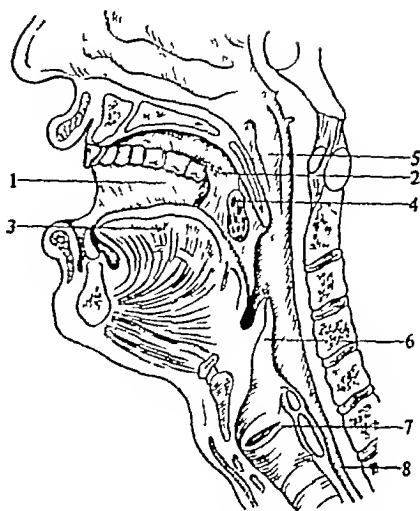


Fig 75 Sagittal section through the nasopharynx

1—mouth cavity, 2—palatoglossal arch, 3—tongue, 4—palatine tonsil, 5—nasopharynx, 6—epiglottis, 7—vocal slit, 8—oesophagus

## PHYSIOLOGY OF THE PHARYNX

The pharynx is the superior portion of the upper airways and the oesophagus and therefore performs many important functions: it takes part in respiration and swallowing, in formation of voice and speech, and performs the protective function.

The participation of the pharynx in the swallowing act is ensured by its muscular elements. After the lump of food has been swallowed the muscles of the pharynx (the superior, the middle and the inferior constrictor muscles) contract one after another and propel actively the swallowed lump



toward the oesophagus. Simultaneously, the soft palate is lifted and pressed toward the posterior wall of the pharynx to preclude passage of the food and liquid into the nasal cavity. At the same time, the muscles of the laryngeal entrance contract, and the true glottis closes to protect the respiratory ducts from aspiration of food and liquid.

When the muscles are not involved in the swallowing act, air passes through the pharyngeal cavity and enters the actively opening entrance to the larynx.

The pharynx cavity (Fig. 75) serves to pass air and food and is at the same time one of the voice resonators. Since the pharynx is the cross of the food and air ways, there are reflectory organs which control the passage of food and air. As air passes through the larynx it is vibrated to form sounds which are then actively modulated into speech by the pharyngeal muscles.

One of the most important functions of the pharynx is protection of the body from the adverse effects of the environment. A special role in this protection belongs to the lymphoid tissue of the Waldeyer-Pirogov ring: the pharyngeal, palatine and lingual tonsils. The lymphoid ring has active antibacterial properties; the tonsils form antibodies which play an important role in the formation of immunity of the body and its increased local and general activity. The pharyngeal mucosa detains dust particles that are suspended in the inhaled air and they are discharged together with mucus. Saliva, irrigating the pharyngeal mucosa, has marked antimicrobial effect. It destroys pathogenic organisms that enter the upper airways and oesophagus together with air and food.

### Examination of the Pharynx Tools and Apparatus Used in Pharyngoscopy

Direct and indirect specular pharyngoscopy are used to examine the pharynx. Indirect pharyngoscopy is examination of the nasopharynx.

Direct pharyngoscopy (examination of the oropharynx) is performed with the use of a spatula and a head mirror.

The patient sits in a chair on the left side of the source of light, his mouth is wide open, the tongue remains in the normal position in the mouth. The beam of a head mirror is directed into the mouth cavity, the back of the tongue is pressed down with a spatula, whose end should not reach the root of the tongue so that the vomiting reflex should not be stimulated.

The palatine tonsils should be inspected by pressing down (with the blunt end of another spatula) the palatine arches by the edge and the upper pole of the tonsils. The tonsils are thus turned outside into the pharyngeal cavity while their contents (pus, epithelial detritus) are expressed from the crypts.

The lower sections of the pharynx (epiglottis, laryngopharynx, upper oesophagus) are inspected by indirect hypopharyngoscopy. The patient is asked to open his mouth wide and protrude the tongue to the maximum (beyond the teeth). Using a piece of gauze, the examiner holds the tongue by the left hand, while using his right hand he inserts a speculum into the pharyngeal cavity to the level of the uvula.

The gustatory receptors are located mainly in the tongue mucosa and (in small quantity) in the mucosa of the pharynx and the laryngopharynx. The gustatory function is tested by sweet (sugar), bitter (quinine hydrochloride), acid (acetic or citric acid) and salt (common salt) solutions.

The lower sections of the pharynx and the entrance to the oesophagus may be examined roentgenologically (with barium as a contrast substance). Both roentgenoscopy and roentgenography are used for the purpose.

### *Review Questions*

- 18 Into what sections is the pharynx divided?
- 19 What accumulations of lymphoid tissue are paired (1) and single (2)?
- 20 What are the main functions of the pharynx?
- 21 Where are the gustatory receptors located?
- 22 What accounts for the protective function of the pharynx?

### ACUTE AND CHRONIC TONSILLITIS (CONSERVATIVE TREATMENT)

Acute tonsillitis is an infectious-allergic disease caused by pathogenic microbes (usually streptococci and staphylococci) that penetrate into the tonsils. Acute tonsillitis may also be concurrent with infectious diseases, such as measles, diphtheritis, scarlet fever, pertussis, and chicken pox. Local and general chills, decreased resistance of the body after severe diseases of other organs and systems are all predisposing factors for the development of acute tonsillitis.

Depending on the character and extent of the process, tonsillitis may be catarrhal, follicular, lacunar, and phlegmonous.

The disease usually begins with a short prodromal period which is characterized by fatigue, weakness, and headache. Strong pain in the throat develops later which is experienced during swallowing, the body temperature rises. Pain in the throat may be so strong that the patient declines food and drinks. Examination of the pharynx reveals strong hyperaemia of the palatine tonsils and the surrounding folds of mucosa, follicular tonsillitis is marked by formation of spot-like plugs (consisting of pus and detritus) in the lymphoid follicles of the tonsils. Lacunar tonsillitis is characterized by the formation of vast greenish-yellow or grey purulent patches in the lacunae of the tonsils. The lymph nodes of the neck become swollen and tender to palpation. Pains in the throat and elevated temperature may persist for 3 to 7 days, but later these symptoms subside gradually. Acute tonsillitis may cause severe complications endangering health and even life of patients. These may be exacerbation (or development) of rheumatism with cardiac and articular symptoms, exacerbation or development of nephritis, aggravation of the course of other chronic diseases of various organs and systems.

*Treatment* The patient should stay in bed and have warm compresses on the neck with ample liquid to drink. The pharynx should be gargled with antiseptic solutions (soda, furacin, ethoxydiaminoacridine lactate, potassium permanganate) 5-6 times a day, sulpha drugs (streptocide, 1 g, 4 times

a day), antipyretics (acetyl salicylic acid) and analgesics (amidopyrin, 0.3 g, three times a day) are given per os. If the condition of the patient is grave, the body temperature is very high, and tonsillitis is concurrent with diseases of other organs and systems, the patient should be given intramuscularly antibiotics (penicillin hydrochloride, 300 000 units, 4 times a day). The nurse should see to it that solutions intended for gargling should be warmed up. Special utensils should be given to patients with acute tonsillitis and kept separately from those of other patients. If acute tonsillitis occurs in a patient of a general somatic or surgical department, he should be moved to an infectious department.

Physiotherapeutic means are efficacious. The tonsils may be exposed to ultra-violet rays (quartz lamp) or UHF waves. Microwave therapy effectively stops the inflammatory process.

In addition to the palatine tonsils, the pharyngeal tonsils may be inflamed too (as an independent disease, acute adenoiditis), as well as the lingual tonsil (lingual tonsillitis).

Tonsillitis concurrent with *diphtheritis* is characterized by the appearance on the tonsils of thick grey patches (films) that may spread beyond the limits of the palatine tonsils onto the soft palate, posterior wall of the pharynx, laryngopharynx, and the larynx, and may cause stenosis of the upper airways and asphyxia.

Acute tonsillitis concurrent with *scarlatina* is, as a rule, catarrhal tonsillitis which persists for several days, in very grave cases the process can only become ulcerous. Treatment and care of patients with scarlet fever and diphtheritis are discussed in detail in special course of infectious diseases.

*Vincent's tonsillitis* is another variation of acute inflammation of the palatine tonsils. The disease is characterized by moderate pains in the pharynx felt during swallowing, and by development of erosions and ulcers (covered with coarse yellowish-white patches) on one or both tonsils. The temperature is not high, the reaction of the submandibular lymph nodes is not marked. The disease is caused by Vincent's organisms (hence the name).

In addition to the described treatment, the ulcerated

tonsils should be coated with a 10% solution of silver nitrate, a 10% hydrogen peroxide solution should be used for gargling

*Syphilis of the pharynx* may pass in its development through all its three stages. The symptoms of primary syphilis resemble those of a sluggish and persistent tonsillitis. The palatine tonsils (usually one of them) are persistently hyperaemic, with small erosions, as if covered with a whitish-blue film. The regional lymph nodes are enlarged but painless to palpation. A typical hard chancre may develop as well. Secondary syphilis is marked by development of roseola eruptions on the pharyngeal mucosa, development of condylomas that look like papillomas. Tertiary syphilis is manifested by gummatous affections, usually of the soft and hard palate or the posterior wall of the pharynx. On healing, the lesions leave specific star-like scars.

Frequently recurring tonsillitis, that develops against the background of decreased local and general reactivity of the body, causes chronic tonsillitis.

*Chronic tonsillitis* is an infectious-allergic disease manifesting in recurrent exacerbations of acute tonsillitis and local signs of chronic inflammation of the tonsils: congestive hyperaemia of the anterior and posterior palatine arches, cicatricial commissures of the palatine arches and the tonsils, the presence of pus and caseous plugs in the lacunae of the palatine tonsils, and enlargement of lymph nodes in the submandibular region. Not all signs of chronic disease, but only some of them, may be observed in certain cases. For example, a patient may have objective signs of chronic tonsillitis without suffering from exacerbations of the disease. And vice versa, a patient may suffer from frequently recurring acute tonsillitis and will have no pathological changes in the tonsils during remissions.

Chronic tonsillitis is a serious disease that decreases significantly the work capacity of the patient and causes general intoxication of the body. At the same time it may become the cause of severe affections of the internal organs such as the heart, kidneys, and joints. Two forms of chronic tonsillitis are thus differentiated: (1) compensated, with comparatively infrequent relapses (one or two times during 1 to 3 years), without marked toxic manifestations or

complications on the part of the internal organs or systems, and (2) decompensated form, with frequent relapses of grave acute tonsillitis, marked chronic inflammatory changes in the tonsils and lymph nodes of the neck.

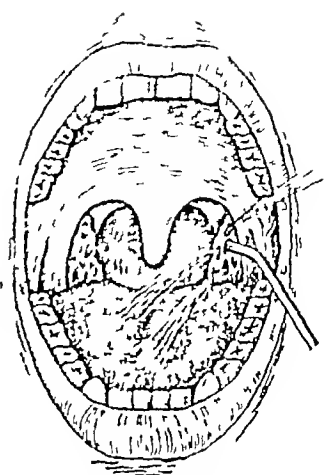


Fig 76 Irrigation of the tonsils

Conservative, semiconservative, and surgical methods are used to treat chronic tonsillitis. One of the most effective conservative methods is physiotherapy. Ultra-violet rays and UHF radiation are still widely used to treat the tonsils and the submandibular lymph nodes (10-15 procedures). Microwaves and ultrasound are now acknowledged to be far more efficacious methods of treating chronic tonsillitis.

Irrigation of the palatine tonsils with antiseptic solutions is an effective procedure as well. The lacunae are irrigated 1-2 times a week and an experienced nurse can manage the patient independently (Fig 76).

A long needle with a blunt end (attic cannula type or a cannula for irrigation of the frontal sinus) and a 20-ml syringe are used for irrigation. The end of the cannula is inserted into each lacuna (under visual control) and an antiseptic solution is expressed under pressure from the syringe. Furacin, rivanol, potassium permanganate, and antibiotics are used to irrigate the tonsils. The patient holds a basin under the chin, with his head bent forward slightly. To preclude aspiration of the washing liquid at the moment of irrigation, the patient should hold his breath.

*Semiconservative treatment* of chronic tonsillitis includes injections of antibiotic solutions (mostly penicillin) in the area surrounding the tonsils. A long (10-12 cm) needle and a 5-ml syringe are required for the purpose. Penicillin hydrochloride solution (50 000 units in 1 ml) in 2-3 ml of 0.5-1% procaine solution is injected into the upper pole of the palatine tonsil, and the anterior and posterior palatine arches.

The procedure is repeated one or two times a week (on each side), the total number of injections being from 6 to 8

Another method of semiconservative treatment of chronic tonsillitis is injection into the palatine tonsils of sclerosing solutions (weak solutions of formaldehyde, alcohol with procaine, etc )

### ADENOIDS

The existing term adenoids does not fully describe the pathology. There may be acute and chronic inflammation of the pharyngeal tonsil (chronic and acute adenoiditis) and pathological hypertrophy of the pharyngeal tonsil (adenoids of the 1st, 2nd and 3rd degrees)

Hypertrophy of the pharyngeal tonsil commonly occurs in children from 2-3 to 14-15 years of age. In later life the adenoid tissue undergoes back development and adenoids occur in rare cases.

The symptoms of adenoids in children are as follows: the parents notice that the baby's nasal respiration becomes impeded, it sleeps with the mouth open, breathes through the open mouth during its active movements (in games). The children often develop permanent or frequently recurring rhinitis, the nasal breathing is difficult even after the use of vasoconstrictive preparations. Impeded nasal breathing or its absence impairs health of the child in general, and its physical and mental growth. The child becomes less active, its work capacity decreases, and the learning process becomes difficult. If the adenoids are not removed surgically in due time, the face features undergo certain changes (the face of an adenoid patient). The diagnosis of adenoids of the 1st, 2nd, or 3rd degree is established by indirect (specular) examination of the nasopharynx. Infants are examined by palpation. To that end the nurse puts the infant into her laps, and arrests the infant's arms by her hands, and the legs by her laps.

Another valuable diagnostic method is roentgenography.

Adenotomy is indicated in hypertrophy of the pharyngeal tonsil of the 2nd and 3rd degrees.

### PARATONSILLAR AND PARAPHARYNGEAL ABSCESES

Paratonsillitis, paratonsillar and parapharyngeal abscesses are frequently occurring complications of acute and exacerbated chronic tonsillitis.

Paratonsillar abscesses arise, as a rule, at the end of persistent acute tonsillitis. Pains in the throat during swallowing intensify again (more frequently on one side only), the body temperature rises to 39-40°C, the pains gradually become more intense so that the patient cannot swallow even liquid food, nor can he sleep.

Intense pains persist for 2-3 days until the abscess ripens and ruptures spontaneously into the mouth cavity. The rupture is followed by a considerable improvement of the condition, the pains subside and the temperature drops. But if the drainage of the abscess is not complete, the process can recur.

In addition to abscesses in the connective tissue surrounding the palatine tonsils, acute and exacerbated chronic tonsillitis may cause abscesses in the lateral and the posterior walls of the pharynx, i.e. parapharyngeal abscesses. Clinical symptoms of this disease are similar to those of paratonsillitis. Parapharyngeal abscesses are characterized by oedema, induration, and swelling of tissues in the posterior or lateral surfaces of the pharynx, or in the laryngopharynx, while in paratonsillitis these changes occur in tissues in the immediate vicinity of the palatine tonsils.

*Treatment* of early stages of paratonsillitis and parapharyngitis may be conservative (before the abscess is formed). This consists in gargling with warm antiseptic solutions, in placing warm compresses on the neck, antibiotics, sulphadiazine, antipyretics and analgesics should also be given. Microwave therapy is effective at early stages. Timely therapy with microwaves is efficacious and in most cases resolves the inflammatory process and in some cases accelerates the process of ripening.

When the abscess has ripened, the main method of treatment is its surgical opening. During the first two or three days postoperative it is necessary to widen the operative aperture in the abscess in order to prevent adhesion of its



walls and development of a relapse. Microwaves are also useful.

Treatment of parapharyngeal abscesses is similar.

It is necessary to remember that development of an acute purulent inflammation in the pharynx, in its lower portions in particular, may be attended with oedema of the surrounding tissues (in the larynx and laryngopharynx) which may cause difficult breathing.

The duties of a nurse are as follows: taking temperature at 3-4 hour intervals (to preclude possible sepsis), the patient should be given antibiotics, sulpha drugs, and ample liquid to drink, warming up compresses (50 % alcohol) are effective means to relieve pain and decrease inflammation, the patient should gargle his mouth and pharynx with warm antiseptic solutions at 30-40 minute intervals. If the disease is severe and attended with high temperature, patients with concurrent diseases of the heart and lungs (2nd or 3rd degree) should be given special care and their cardiopulmonary function watched carefully. Cardiac preparations should be given by the nurse in accordance with prescriptions of the physician.

## SURGICAL TREATMENT OF DISEASES OF THE PHARYNX AND NASOPHARYNX

### Pre- and Postoperative Treatment of Patients

Patients with diseases of the pharynx and nasopharynx are treated surgically by adenotomy, tonsillotomy, tonsillectomy and other surgical operations.

Adenotomy is the surgical removal of the pharyngeal tonsil. The operation is normally performed in childhood in outpatient conditions. The following is required for the operation: total blood and urine analysis, test for blood coagulability, thrombocyte count, erythrocyte sedimentation rate. Moreover, the paediatrist should examine the child for the absence of contraindications to the operation. The results of the bacteriological examination of a smear from the fauces for diphtheria should also be available.

The child should not take meal in the evening before the operation (and in the morning on the day of the operation) Sedatives or hypnotics (phenobarbital, diazepam, seduxen) should be given to children with unbalanced psyche in the evening before the operation

The operation itself should be done with local anaesthesia (instillation into the nose of 1-3 % dicaine or 5-10 % cocaine hydrochloride [solution]) Adenotomy takes a few seconds Fixation of the child during the operation takes special care The nurse dresses the child in sterile operation clothes and positions the child in her laps so that its legs might be fixed between the thighs of the nurse, by her arms the nurse holds the child tight by its trunk and the arms as shown in Fig 77 Another nurse may hold the child's head in position convenient for the operation The following tools are necessary a spatula, a probe for anaesthesia of the pharynx and the nasopharynx, adenotomes, and fenestrated forceps (Fig 78)

Profuse bleeding may occur in some cases, and a special set of tools and materials for posterior tamponade should therefore be prepared beforehand (see 'Nasal Bleeding')

After the operation the child should be kept quiet in bed for 25-30 minutes As soon as bleeding becomes moderate (mucosanguineous discharge from the nose and the nasopharynx) and then discontinues, the child may be sent home (accompanied by the relatives or medical personnel)

In order to shorten the time of nasal bleeding, the child may be given pieces of ice (or ice-cream) to suck and swallow.

On the day of the operation the child should be given only cool liquid food such as cream, broth, fruit juices, etc Spicy,



Fig 77 Immobilization of a child for removal of tonsils or adenoids.



and the latter is cut off. The nurse should assist the surgeon, giving him the necessary tools and materials, and watch the condition of the patient. Immediately after the operation the patient is asked to lie on his side and to spit out (not swallow) the saliva and blood into the basin or napkin. When bleeding stops completely, the patient may be dismissed and accompanied home by the relative or medical personnel. The operated patient is recommended to keep home for at least 5-6 days postoperative, all physical load is contraindicated. The patient should take cool food and liquids. Antiseptic solutions should be used to gargle the mouth (potassium permanganate, furacin, rivanol). The mouth should also be gargled after meals.

One of the most widely used operations is *tonsillectomy*, that is complete removal of the palatine tonsils. Chronic tonsillitis is the indication for the operation.

The operation should be done at a hospital only. Before the operation the patient should have his urine and blood tested (test for blood coagulability, thrombocyte count, Wassermann's reaction, and establishing the blood group and the rhesus factor). The patient should also have his chest examined with X-rays, and the internist should examine him for the absence of contraindications to the operation on the part of the internal organs. The mouth (teeth) should be sanated before the operation as well. If the patient is over 40 or suffers from severe diseases, for example, cardiovascular pathology (hypertension, myocardial infarction in the anamnesis, etc.), he should undergo special examinations, including ECG, etc., and be specially premedicated.

On the day of operation the patient should not take food or drink. The nurse sees to it that the patient takes a bath one or two days before the operation and his physiological functions are normal.

If the patient is excited, hypnotics or sedatives should be given on the night before the operation. The nurse should watch the patient sleep, and takes his evening and morning temperature. If the temperature is elevated, the nurse should report to the doctor.

The patient is seated for operation in an otorhinolaryngological chair and the operation is performed (as a rule)

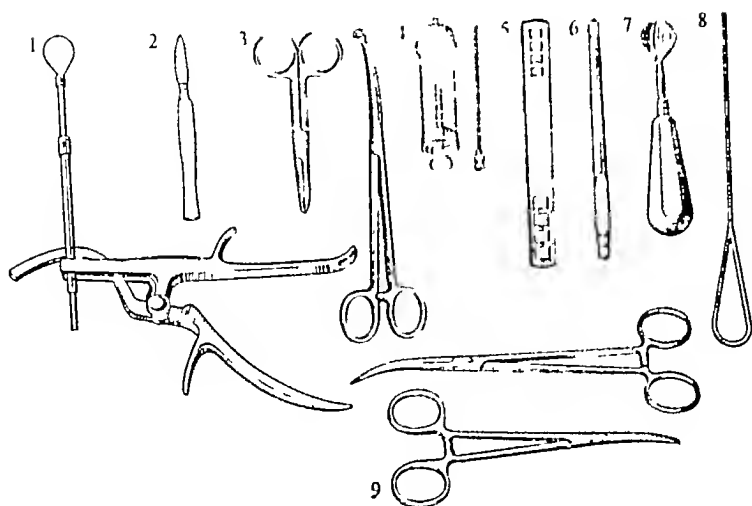


Fig 79 Tonsillectomy tools

1—Bakhon loop (for cutting off the lower pole of the tonsil), 2—scalpel, 3—scissors, 4—syringe and a long needle, 5—spatula, 6—raspatory, 7—separator spoon, 8—probe for anaesthesia, 9—forceps

with a local infiltration anaesthesia with 0.5% or 1% procaine hydrochloride. In rare cases (for example, intolerance of procaine) the patient may be narcotized.

To ensure effective anaesthesia, to decrease salivation, and to shorten the time of operation, the nurse should inject 1 ml of a 2% promedol and 1 ml of 0.1% atropine sulphate solution to the patient 20-25 minutes before the operation. The patient should take off his overcoat in the preoperative room and put on an oilcloth apron. The nurse leads the patient to the operation room. She wipes the face of the patient with alcohol, and covers his body with a sterile sheet so that the face only remains open. The patient is given a basin to hold (through the sheet), into which the saliva and blood may be spat out. After anaesthetizing the patient, the tonsils are separated from the surrounding tissues by raspatories and cut off by special loops (Fig 79). Considerable bleeding usually follows which should be controlled by the physician with tampons held in long forceps.

Bleeding may in some cases be strong and ligatures should then be placed on the incised vessel or the palatine arches sutured above the tampon.

At the end of the operation, the nurse wipes the patient's face with a napkin, takes off the apron, helps to dress, and carries him on a wheeled cart into the ward. The patient should not be allowed to walk unassisted, because he may faint or bleeding may be resumed. The nurse should undress the patient in the ward and place him in bed on his side on a low pillow. A sheet should be placed under the head so that the patient could spit out the blood and saliva. It is necessary to keep watch on the patient so that he should not swallow the saliva and blood that may accumulate in the mouth, because it will then be difficult to assess properly the extent of bleeding and the patient may lose much blood. The patient is not allowed to talk, to leave the bed, or make other active movements until next day. The nurse should keep a systematic watch on the patient as not to overlook bleeding that may occur. As a rule, the saliva contains no blood in two or three hours and the patient is allowed to drink cool milk, cream, or tea in the evening. If bleeding does not stop or intensifies, the nurse should report to the doctor.

If bleeding is not significant, the patient is given an ice bag on the neck, and pieces of ice in the mouth to suck, vikasol may be given subcutaneously.

Strong bleeding requires care of the doctor. On the second day following the operation the patient is given food through a sound. The diet should be sparing during 7-10 days postoperative. Spicy, bitter, sour and salt food is not allowed. Food should be cooled before use. Hot baths or physical load are prohibited.

The temperature may rise to  $37.5-38^{\circ}\text{C}$  (and over) during the first days postoperative and sulpha drugs or antibiotics should be given. On the second day after the operation, the wound surface is covered with a coarse grey coat and antiseptic solutions should be used to gargle several times a day. The coat disappears in 6-8 days and complete epithelization is observed by the end of the second week. The patient may be allowed to resume his routine duties. No limitations on food and activities are imposed any longer.

If there are direct indications for tonsillectomy (frequent and persistent acute tonsillitis attended with elevated temperature and pronounced intoxication, exacerbation of

rheumatism, rheumocarditis, renal diseases) but the condition of the patient (a grave heart disease, cardiovascular pathology) or his age contraindicates tonsillectomy, the tonsils are removed by a cryogenic method, using a special apparatus cryoapplicator, by which the palatine tonsils are destroyed by extreme cold. The operation is performed in the same conditions as tonsillectomy and is done in three or four steps at 6-8 day intervals.

### *Review Questions*

- 23 What is acute tonsillitis?
24. Can acute tonsillitis be concurrent with children's infectious diseases such as (1) measles, (2) diphtheritis, (3) scarlet fever, (4) mumps?
- 25 Name types of acute tonsillitis
- 26 What are the main complaints of patients with acute tonsillitis?
- 27 What severe complications may develop after acute tonsillitis?
- 28 What are the characteristics of diphtheria tonsillitis?
- 29 What is chronic tonsillitis?
- 30 What is the most efficacious physiotherapeutic method to treat chronic tonsillitis? (1) quartz lamp, (2) UHF waves, (3) ultrasound, (4) microwaves?
- 31 What are adenoids?
- 32 What is adenoiditis?
- 33 What are the symptoms of adenoiditis in children?
- 34 Can adenotomy be performed in out-patient conditions?
- 35 Can tonsillectomy be performed in out-patient conditions?
- 36 What are the most frequent complications of tonsillectomy?

### *Answers to Review Questions*

- 18 Nasopharynx, oropharynx and laryngopharynx
- 19 (1) palatine, (2) nasopharyngeal, lingual
- 20 Swallowing and respiration, voice- and speech formation, protective function
- 21 In the mucosa of the tongue and, in small quantity, in the mucosa of the pharynx and laryngopharynx

- 22 Lymphoid ring, mucosa, saliva
- 23 Acute infectious-allergic disease caused by pathogenic microbes which attack the tonsils
- 24 (1) yes, (2) yes, (3) yes, (4) no
- 25. Catarrhal, follicular, lacunar, phlegmonous
- 26. Pain in the throat during swallowing, general weakness, elevated temperature
- 27 Exacerbation of rheumatism, myocarditis, nephritis, aggravation of the course or exacerbation of chronic diseases of various organs and systems
- 28 By the presence of thick grey patches (coat) that may extend to the soft palate, posterior wall of the pharynx, laryngopharynx, and the larynx
- 29. Infectious-allergic disease manifesting in recurrent acute tonsillitis and local signs of chronic inflammation of the tonsils
- 30 4, 3
- 31 Hypertrophy of the pharyngeal tonsil
- 32 Inflammation of the pharyngeal tonsil
- 33 Impeded nasal respiration, relapsing rhinitis fatigue, inactive behaviour
- 34 Yes
- 35 No
- 36 Bleeding



## Chapter 3

# Diseases of the Larynx, Trachea, and Cervical Oesophagus

### ANATOMY AND PHYSIOLOGY OF THE LARYNX, TRACHEA, AND CERVICAL OESOPHAGUS

The *larynx* is a hollow organ with a complicated structure, connecting the pharynx and the trachea, and performing very important physiological functions. Anteriorly the pharynx is separated from the larynx by the epiglottis, laterally by arytenoepiglottic folds (laterally to which are found the pear-shaped sinuses, which are transformed into the oesophagus in the inferior and posterior portions). The posterior border between the pharynx and the laryngopharynx are the mucosa-lined arytenoid cartilages, which are continuous with the entrance to the oesophagus (Fig 80).

A ring formed by the epiglottis, arytenoepiglottic folds and posterior portions of the arytenoid cartilages makes the vestibule of the larynx (the external laryngeal ring). Inferiorly to the arytenoepiglottic folds and parallel to them are found the vestibular folds that originate at the middle portion of the epiglottis and terminate at the lateral portions of the arytenoid cartilages. These anatomical structures are thus a part of the external laryngeal ring (they are the borderline between the external ring and the middle part of the larynx).

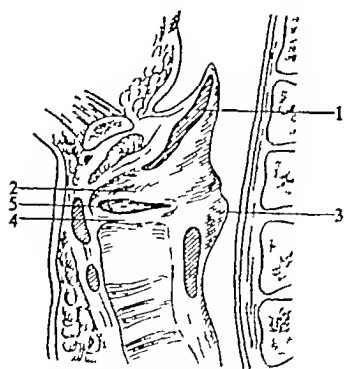


Fig 80 Sagittal section of the larynx

1—epiglottis, 2—vestibular folds, 3—arytenoid cartilage, 4—vocal folds, 5—Morgagni's recess

The larynx consists of a cartilaginous framework, whose separate parts are interconnected by ligaments, internal mucosa-lined muscles, and the external laryngeal muscles.

The cartilaginous structure of the larynx includes the thyroid cartilage formed by two lateral plates connected anteriorly along the median line and opened posteriorly. Superiorly the thyroid cartilage is attached to the body and the long horns of the hyoid bone by means of a thyrohyoid membrane and two thyrohyoid muscles. The lower portion of the thyroid cartilage rests on the cricoid cartilage where anterior portions form a ring-shaped cartilaginous plate which is connected with the thyroid cartilage through a thyrocricoid membrane. The ring of the cricoid cartilage broadens posteriorly to form a signet which is found between the posterior portions of the thyroid cartilage. Two arytenoid cartilages are located directly on the signet of the cricoid cartilage, and the vocal muscle is attached to the processes of the arytenoid cartilages. The mucosa-lined vocal muscle forms the true glottis (*rima glottidis*). Muscles dilating the larynx (transverse and oblique muscles, and arytenoid muscle) are attached to the posterior portions of the arytenoid cartilages. The vocal cords are located in the horizontal plane at the level of the lower third of the thyroid cartilage. Mucosa-lined recesses (*Morgagni's ventricles*) are located between the vestibular and vocal ligaments.

The lower borders of the larynx pass along the inferior edge of the cricoid cartilage, further the larynx is continuous with the cervical portion of the *trachea*, which is a hollow tube with the framework formed by 6 or 8 cartilaginous rings. The posterior wall of the trachea has no cartilage and consists of firm connective tissue bordering with the anterior wall of the oesophagus. Lateral thyroid lobes are found by sides of the larynx and the trachea. They meet at the level of the first tracheal rings to form the isthmus. The thyroid and cricoid cartilages are connected with the sternum (breast bone) through sternothyroid and sternocricoid paired muscles. Laterally to the larynx and the trachea, at the level of the anterior edge of the sternocleidomastoid muscle (inferiorly to it), found is the cervical vasonervous bundle consisting of the common carotid artery, jugular vein, and the nervus vagus. The common carotid artery bifurcates into the interior and exterior carotids at the level of the upper edge of the thyroid cartilage. The external carotid artery ramifies to supply blood to the larynx and the trachea (the

superior thyroid and the sublingual artery) The larynx is innervated by the branches of the nervus vagus (the superior and inferior laryngeal nerves)

The cervical portion of the *oesophagus* begins below the arytenoid cartilages, at the level of the 5th cervical vertebra

A constrictor muscle, known also as the mouth of the oesophagus, is situated at the vestibule of the oesophagus The portion of the oesophagus extending from the constrictor muscle borders by its anterior surface with the posterior wall of the inferior portions of the larynx and the membranous portion of the cervical trachea Posteriorly the oesophagus borders with the prevertebral fascia

The larynx performs vital functions such as respiratory, protective (separating), and voice-forming.

During respiration, air is inspired by vacuum in the pleural cavity created by elastic pulmonary tissues The inspired air passes the nose (or mouth) to enter the larynx The vestibule of the larynx opens by relaxation of the muscles in the external ring of the larynx and the vocal folds The vocal slit widens to admit air through the trachea into the bronchi and the lungs As the air stream passes the larynx and the trachea it is warmed up and cleansed from dust particles suspended in the inhaled air, which precipitate on their walls The laryngeal and tracheal mucosa is coated with ciliated epithelium whose cilia remove dust particles and propel them together with mucus toward the larynx

The protective or separating function of the larynx protects the upper airways from aspiration of liquids and food The protection is effected reflectory As food is being swallowed, the soft palate is lifted, pressed against the posterior wall of the pharynx to close the entrance to the nasopharynx Food is propelled along the lateral walls of the larynx toward the vestibule of the oesophagus At this moment the larynx is lifted, the epiglottis lowers over the entrance to the larynx, and the external ring is contracted to close the airways and to open the entrance to the alimentary tract A strong muscular layer underlies the mucosa of the lower larynx and the upper oesophagus Food does not therefore passively drop but is propelled through the oesophagus into the stomach by consecutive contraction and relaxation of the muscles. This

explains the fact that a man can swallow food and drink liquid with his head below the level of the body

The function of the larynx as an organ of voice is effected by modulated vibrations of the expired air stream as it passes the vocal cords. As the voice is thus produced, the overlying articulating apparatus of the mouth shapes it into speech or singing. When an expired air passes the open vocal slit, the man voluntarily (by conditioned reflex) contracts the vocal cords, and by varying the strength of these contractions, produces modulated vibration of the air stream. As the sounding air passes further through the mouth cavity, it is transformed into an articulate speech by the tongue, hard and soft palate, teeth, cheeks and lips. Part of the air stream passes through the nasal cavity as well, and this is important in formation of the voice timbre.

### Examination of the Larynx, Trachea, and Cervical Oesophagus Endoscopic Tools and Apparatus

The larynx, trachea and oesophagus are examined by complicated methods. There exist direct, indirect, and instrumental methods by which the ear, nose and throat may be examined.

*Direct methods* include inspection and palpation of the framework of the larynx and the trachea through the soft tissues of the throat, inspection of the anterior and lateral regions of the throat can also be referred to direct methods of examination.

The shape of the laryngeal and tracheal framework may be changed by closed injuries or tumours.

*Indirect methods* include laryngoscopy with specula (normally without anaesthesia). The patient is seated in a chair with his mouth open and the tongue extended as much as possible. The source of light should be on the left of the patient. The examiner takes hold of the tongue by the thumb and the middle phalanx of the forefinger of the left hand and pulls carefully downwards. The head mirror should cast light on the uvula. Using the right hand, the examiner introduces the laryngeal speculum into the mouth. (The mirror



Fig 81 Indirect Laryngoscopy

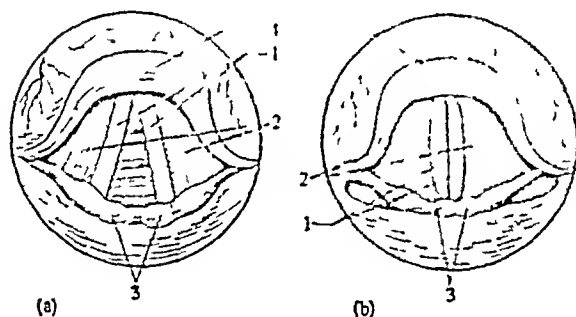


Fig 82 Image of the larynx in indirect laryngoscopy  
*a*—inhalation, *b*—during phonation 1—vocal folds, 2—vestibular folds, 3—arytenoid cartilage, 4—epiglottis

should first be warmed up over the flame of a spirit burner or in hot water) The rear surface of the speculum should press back the uvula toward the posterior wall of the pharynx. The mirror should be held at an angle of  $45^{\circ}$  to the horizontal line. The light beam reflected from the head mirror illuminates the larynx. The image in the mirror is reversed: the anatomic structures seen in the upper part are located in the anterior parts of the larynx while the lower image is the picture of the posterior laryngeal structures (Figs 81 and 82)

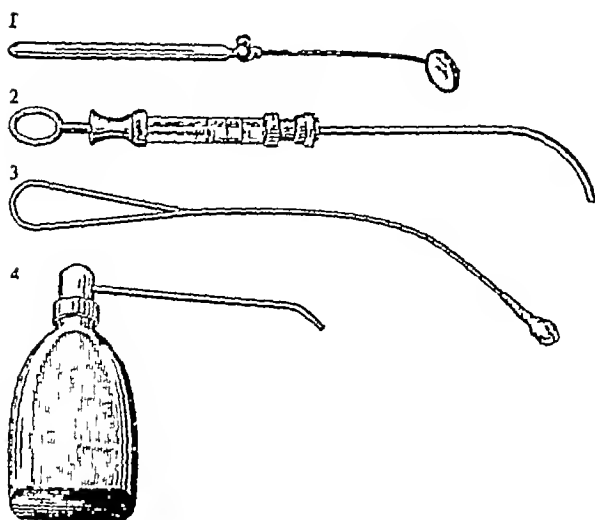


Fig 83 Tools for anaesthesia of the larynx and laryngopharynx  
 1—laryngeal speculum, 2—laryngeal syringe, 3—a probe with cotton  
 wool wound round the end, 4—sprayer

When out of use, the laryngeal speculum should be kept in alcohol or an antiseptic solution. In separate cases, if the vomiting reflex in the patient is increased, or the epiglottis covers the entrance to the larynx, local anaesthesia should be used in indirect laryngoscopy. The pharynx and the larynx are irrigated with an anaesthetizing solution (5-10% cocaine or 1-3% daine solution), or anaesthetic preparations are injected by a syringe (Fig 83). In this case, the patient himself holds his tongue while the physician displaces anteriorly the epiglottis by the left hand using a laryngeal probe wrapped in a piece of cotton wool. The procedure is controlled by a speculum which is introduced into the larynx by the right hand of the physician.

Widely used at the present time are direct laryngoscopy and laryngotracheobronchoscopy. A bronchoscope is used for the purpose. Other direct methods of examination of the larynx, such as oesophagoscopy and tracheobronchoesophagoscopy, are performed with fibre optical apparatus.

Direct instrumental examination of the larynx should be done with local anaesthesia or narcotics, the procedures may be used for both diagnostic and therapeutic purposes. Since

vomiting is possible, patients with a fasting stomach should be examined

Several modifications of laryngotracheoesophagoscopes are used for direct laryngoscopy

Microlaryngoscopy (with anaesthesia) is now widely used. The tool used for the purpose is actually a combination of an operation microscope, a laryngoscope and an anaesthetizing apparatus

The patient is placed on his back with the head thrown back. The tool is moved into the mouth along the median line of the tongue, its root being pressed anteriorly to expose the lids of the epiglottis. The epiglottis is then also displaced anteriorly to expose all structures of the larynx: the arytenoid cartilages, vestibular and vocal folds, hypovocal parts of the larynx and the upper portions of the trachea.

A special instrument, tracheobronchoscope, is used for laryngotracheoscopy and oesophagoscopy. Bruenings and Meurin's bronchoscopes (see Fig. 84, *a* and *b*) are mostly used now.

The larynx, trachea, and the oesophagus are normally inspected with local anaesthesia, with a patient in the sitting position.

A rigid straight metal tube is used for inspection of the larynx and trachea or the pharynx and oesophagus; this is possible because with a certain position of the patient body and head, its mouth cavity, the larynx, the trachea and the oesophagus may be arranged along a straight line. When *bronchoscopy* or *oesophagoscopy* is performed on a sitting patient, the role of the medical nurse becomes very important. She prepares the bronchooesophagoscope, cotton wool for removal of mucus, aspirators, and forceps. The patient is seated in a low chair, the nurse stands behind him with her knee pressed between his shoulder blades to straighten his chest, using her hands the nurse holds the patient's head fast and lowers it posteriorly to the maximum extent with the chin pointed upward. After the procedure has been completed, the patient is allowed to sit for a while to quiet himself, and then the nurse accompanies him to his bed. The patient should be given cooled semiliquid (sparing) food during the first 24 hours following the oesophagobronchoscopy. His general condition, breathing, intensity of the pain syn-

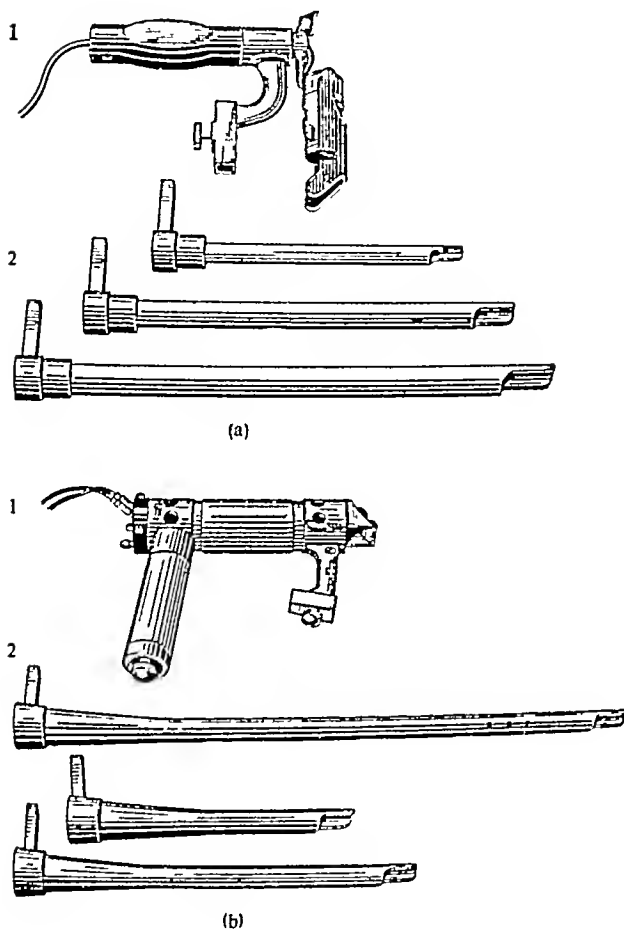


Fig 84 Bronchoesophagoscopes

*a*—Bruenings bronchoscope 1—handle with an illuminating system, 2—endoscopic tubes, *b*—Mezrin's bronchoscope 1—handle with an illuminating system, 2—endoscopic tubes

drome, and body temperature should be watched so that possible complications (such as oedema of the larynx, perforation of the oesophagus or trachea, mediastinitis, etc ) should not be overlooked

Sometimes tracheobroncho- or oesophagoscopy with local anaesthesia becomes impossible or undesirable. A Friedel bronchoscope should then be used to narcotize the patient



This is a special bronchoesophagoscope incorporating a device intended to give a narcotizing mixture straight into the trachea of the patient

The larynx performs very important functions and is located at the border-line of the respiratory and alimentary tracts. The narrowest portion of the respiratory duct, where stenosis (with difficult breathing) may occur, is located at the level of the vocal slit. This accounts for the special features of general treatment of diseases of the larynx and care of patients.

The larynx is not easily accessible for direct medicamentous treatment and inhalation of atomized medicinal preparations, instillation of liquid drugs using a special syringe, applying externally various medicinal preparations to the larynx mucosa, and physical methods of treatment are therefore used.

The larynx is a voice-forming organ and its *therapy* should therefore be sparing so as not to impair this important function. The patient should abstain from unnecessary conversations or at least should speak in a low voice. Whispering is not recommended either.

Inhalation of medicinal preparations should be done with special apparatus by which the drug is atomized by air or vapour.

Inhalators of several types are known. These are manual (for individual use), portable (that may be used in various conditions), and stationary inhalators that are mounted in a special room.

Alkaline and oil inhalations are normally used. Alkali dissolves crusts and thick mucus, and promotes their better separation and expectoration. Oil (vegetable obligatory) coats the mucosa by a thin film to protect it from undesirable effects.

Antibiotics, corticosteroids, proteolytic enzymes, antihistamine preparations, etc. are also used for inhalation in the therapy of the upper airways.

Applying medicinal preparations to the mucosa and also administration of these preparations into the larynx by a syringe are described in 'Examination of the Larynx, Trachea, and Cervical Oesophagus'.

UHF and micro-waves, electrophoresis with various medic-

inal preparations, and also ultrasound are used to control inflammatory processes

Difficult breathing through natural airways, i.e. stenosis of the larynx, is the most serious complication of specific and non-specific inflammation, injuries and tumours of the larynx. The most important duty of the nurse is therefore a careful watch of the patient's respiration. The first signs of stenosis are noisy breathing, restlessness of the patient in his sleep (especially in a certain position of the body) and dyspnoea under increased physical load.

A more pronounced stage of stenosis is marked by hoarse breathing, changed voice, cyanosis of the visible mucosa of the lips, mouth and nose, the tips of the nails become blue. Respiration may be difficult during expiration and inspiration.

The medical nurse should keep a careful watch of the patient's breathing, especially if the patient is a child with acute laryngitis. When first signs of difficult breathing appear, mustard plasters should be applied to the chest, the feet should be kept in hot water containing mustard, and a warming bandage or a semialcohol compress applied to the neck. If the condition worsens (progressing stenosis of the larynx and trachea), a physician should be summoned, the nurse should meanwhile prepare a set of tools and instruments for tracheotomy that may become necessary. The air in the room should be fresh, cool, and sufficiently moist.

Injuries and tumours of the larynx and the oesophagus are in most patients the result of tracheotomy for asphyxia.

Daily care of tracheostoma consists in treatment of the surrounding skin with alcohol or other antiseptic or tanning solution, administration of soda and oil solutions through the tube (to promote expectoration) and in cleaning the tube. To do so, the flap on the tube base is moved aside, the insert is removed from the main tube, washed thoroughly with hot water, and replaced. The tracheostomic tube is replaced by a physician if the patient was operated not long ago. Subsequent renewal of the tube may be performed by the nurse.

The skin round the tube should be treated with benzine, alcohol or hydrogen peroxide to clean it from crusts. A pad of 4-6 layers of gauze should then be placed under the tracheostomic tube and, if necessary, an aseptic bandage placed atop

*Review Questions*

- 37 What are the structural elements of the external laryngeal ring?
- 38 What tissues form the larynx?
- 39 What cartilages form the framework of the larynx?
- 40 Where do the larynx and the trachea border?
- 41 Where does the cervical portion of the oesophagus originate?
- 42 What are the main functions of the larynx?
- 43 What elements form the vocal slit?
- 44 What are the methods of examination of the larynx, trachea and oesophagus?
- 45 Name modern direct methods of examination of the larynx, trachea and oesophagus
- 46 What is microlaryngoscopy?
- 47 What anaesthetic methods are used in instrumental laryngotracheoesophagoscopy, local (1) or general (2)?

CARE AND MANAGEMENT OF PATIENTS WITH  
DISEASES OF THE LARYNX,  
TRACHEA, AND CERVICAL OESOPHAGUS

**Diphtheritis** is an acute infectious disease caused by Loeffler's bacillus. Many children usually died from diphtheria but in later decades the morbidity rate has sharply decreased in this country due to effective antiepidemic measures. Moreover, the course of the disease has become less severe.

The disease begins with general symptoms and affection of the pharynx. Primary affection of the pharynx and laryngopharynx occurs in very grave cases. In addition to the general anti-infectious measures, special attention should be paid to breathing of the affected child and intubation should be made when the first signs of stenosis of the larynx develop. **False croup** (acute spasmodic croup). In contrast to diphtheritic croup, it develops along with an acute respiratory disease and attacks mostly infants. False croup manifests by catarrhal changes in the fauces, pharynx, and the larynx, and is attended with rhinitis, indisposition, headache. In severe cases, the mucosa in the larynx lying beneath the vocal cords swells, becomes indurated, and closes part of the lumen of

the larynx to extend beyond the vocal folds. Cough becomes resonant barking, with spasmodic attacks. Dyspnoea develops progressively along with cyanosis of the visible mucosa, the tissues between the ribs and over clavicles become depressed during inspiration. Death from asphyxia may occur unless urgent measures are taken.

When the first signs of false croup develop (attacks of barking cough) the nurse should take urgent measures: the patient should be kept in bed, antipyretic and anti-oedema preparations (acetylsalicylic acid, amidopyrine, analgin, dimedrol, suprastin, hydrocortisone) should be given and a warming compress applied to the neck (together with hot mustard bath for feet).

When signs of laryngeal obstruction develop (difficult breathing), an urgent medical aid is required. A set of tools for tracheotomy should always be kept ready in departments where patients with false croup are treated.

Stenoses of the larynx and trachea are classified as *acute* and *chronic*. Acute stenosis develops as a result of inflammatory and infectious diseases or due to injuries of the larynx and the trachea (for more details see the previous chapter). If a blow is inflicted by a dull or a sharp object in the region of the larynx and the trachea, their cartilaginous framework may be broken, the larynx, trachea and the oesophagus may rupture and the inner tissues injured. All these injuries may be attended with acute post-traumatic stenosis of the larynx or the trachea.

Subcutaneous ruptures of the larynx and trachea are attended with a prompt development of asphyxia: difficult breathing, blood in the saliva and the sputum, blood may issue from the nose and the mouth. Subcutaneous emphysema develops due to penetration of the expired air that passes through the broken tissues of the larynx and the trachea. The neck swells and crackling sound (air bubbles) is distinctly heard when the neck is palpated. Obstructed breathing ends in asphyxia and the patient will die unless he is urgently tracheotomized.

Profuse bleeding usually attends open injuries of the larynx. If the carotid artery is injured, the bleeding is pulsating (fountain). Unless urgent measures are taken (the carotid artery should be pressed) the patient dies in a few seconds.

The issuing blood foams, the patient utters hoarse sounds, his breathing is obstructed. First aid in open injuries of the neck consists in dilation of the wound edges and introduction of a tracheotomic or any other tube into the lumen of the broken larynx and trachea. Bleeding should also be stopped. All other surgical operations should be done in stationary conditions.

Chronic stenoses of the larynx may develop due to paralysis of the internal laryngeal muscles, usually after strumectomy (partial or complete removal of the thyroid gland), when the inferior laryngeal nerve is injured surgically. Paralysis may be unilateral or bilateral, complete or partial (paresis).

If paralysis of the recurrent nerve is unilateral, the patient would usually complain of hoarseness, fatigue during speaking, changes in the voice timbre. The breathing is not affected substantially. The voice would normally be restored in the lapse of time but the fatigue remains. Laryngoscopy reveals immobility of one half of the larynx during phonation and the vocal fold usually remains in position close to the median line, the vocal slit opens only partly during inspiration.

Voice may remain unchanged in bilateral paralysis of the larynx (its strength is only impaired), but the patient would complain of difficult breathing.

Other causes of stenosis are cicatricial narrowings of the larynx and the trachea due to previous injury, tracheotomy, or grave infectious diseases (measles, diphtheria, typhus, abdominal fever, syphilis, scleroma, tuberculosis). In all these cases breathing becomes gradually impaired, either immediately after the disease or in a lapse of time. Since cicatricial stenosis develops slowly, the patient would normally adapt himself to the gradual constriction of the airway and decreased intake of oxygen with the inhaled air. The adaptive faculty is very strong in some patients and an adult may breathe in air through a vocal slit measured by a millimetre.

Chronic cicatricial stenoses are *treated surgically* in several steps. To ensure normal breathing, a tracheostoma is first formed. The larynx and the trachea are then incised at the level of the cicatrix (laryngotracheofissure) with instantane-

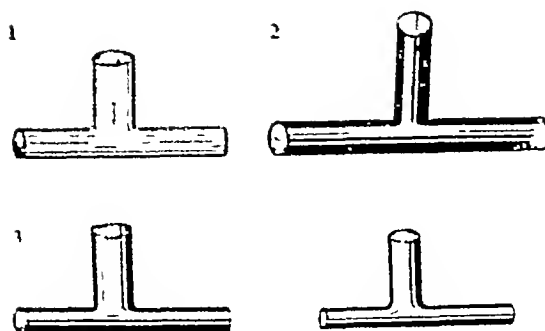


Fig 85 T-tubes

1—a silicone tube with an oval stem 2—rubber tube with a round stem, 3—rubber tubes with oval stems



Fig 86 A T-tube inserted in a tracheostoma

ous incision of the cicatrices closing the air-pipe lumen. Special plastic tubes (usually T-tubes as shown in Fig 85) are inserted into the tracheostoma of the patient for a time measured from a few weeks to a few months. The tube remains in the tracheostoma until the lumen becomes sufficiently wide to ensure normal breathing (Fig 86). The laryngotracheofissure (the opening in the outer wall of the larynx and trachea) is then sutured and the patient recovers normal breathing.

After laryngotracheotomy for paralysis of the larynx, a surgical intervention on the vocal folds or the arytenoid cartilages is undertaken to widen the lumen of the vocal slit and to remedy stenosis of the larynx. Special skill is required on the part of the nurse to take care of these patients.

Tumour is a frequently occurring affection of the larynx. Tumours may be benign (fibroma of the vocal fold, angio-fibroma, polyps, cysts) and malignant (cancer and sarcoma of the larynx).

Depending on localization in the larynx, the newgrowth is manifested by different symptoms. For example, tumours of the vocal folds may manifest themselves sooner than other tumours because they interfere with normal voice formation (hoarseness).

If a malignant tumour is located in the vestibular portion of the larynx, its symptoms are late (when the tumour is already of significant size). The patient may feel pain during swallowing of the saliva or food, the pain may irradiate into the ear. Malaise and fatigue are other manifestations of the tumour.

Development of a malignant tumour in the region of the vocal folds usually causes stenosis of the respiratory duct due to impaired mobility of the vocal folds (contraction of the vocal slit) or mechanical obturation of the airways.

Benign tumours (the character of tumour is established by histological examination of material taken during biopsy) are usually treated by their endolaryngeal removal. But a benign tumour may propagate over vast area, and a more radical operation may be required with an external approach.

Treatment of malignant newgrowths includes vast resection of the laryngeal tissues or complete removal of the larynx with pre- or postoperative radiotherapy.

Development of benign or malignant tumours in the larynx and the trachea is attended by narrowing of the airway lumen which makes breathing difficult. The first step in the operative treatment of these patients is forming a tracheostoma.

Small benign tumours are removed endolaryngeally with indirect laryngoscopy using special tools shown in Fig 87. The operation is performed in out-patient condition with local anaesthesia 1-2% dicaine or 5-10% cocaine solution.

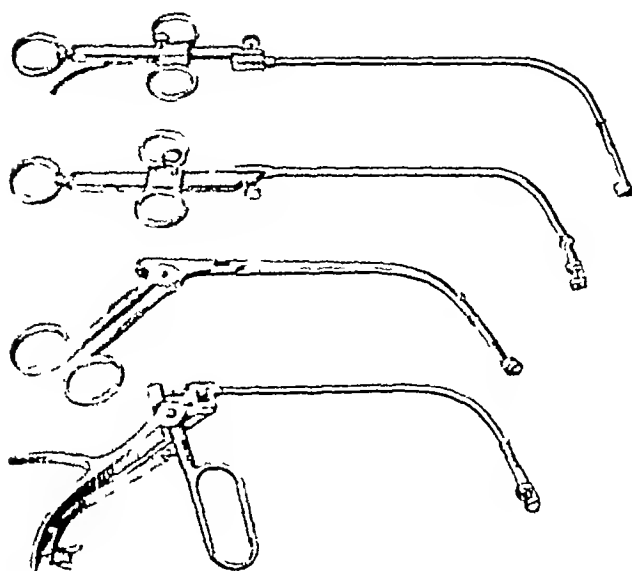


Fig 87 Tools for removal of newgrowths of the larynx and taking biopsy specimens

is applied externally. The operation is performed on a patient with a fasting stomach. The patient is given subcutaneously 1 ml of a 2% promedol with 1 ml of 0.1% atropine sulphate solution, 20-30 minutes before the operation. The patient should first be examined for coagulability of his blood, his urine should also be tested, and a therapist should pass a conclusion on his general condition (the absence of contraindications with respect to the internal organs). The medical nurse prepares the surgical tools that may be required to give anaesthetics and to perform biopsy, and is constantly present by side of the physician and the patient during the operation. After the operation is completed, the patient should be observed for 60-90 minutes and then accompanied by the nurse to his home. The patient should abstain from taking hot, bitter, and salt food and also physical loads during the first 24 hours postoperative. The patient should spare his voice this period of time and be given a sick leave for 5-7 days. The physician should examine the patient in 1-2 days following the operation.



*Diagnosis* of a malignant newgrowth of the larynx is established by clinical observation, x-ray examination, tomography of the larynx and biopsy. The patient with a malignant tumour is treated at a special institution (oto-rhinolaryngological department of an oncological hospital or at an oncological dispensary).

Modern medical science is capable of curing about 80-90% patients with malignant tumours of the larynx provided the diagnosis has been established at early terms.

The Soviet medicine has achieved great advances in treating *tuberculosis* and occurrence of tuberculous affections of the larynx is therefore low. They show clinically as lengthy and persistent inflammatory processes. Their incidence is rare. In cases where pathology persists for long periods of time and resists common treatment, patients with inflammation of the larynx should be given special (pulmonological) examination.

Care of such patients is the same as of patients with specific infectious diseases.

*Syphilis of the larynx* (and of the other parts of the upper airways) is the manifestation of the general syphilitic process. Primary syphilis of the larynx occurs in rare cases. Secondary syphilis of the larynx is marked by development of papules and roseolas, i.e. by persistent inflammatory process of the larynx and laryngopharynx. Local diagnosis is difficult and the disease is identified by common examination, anamnesis, Wassermann's reaction, Nonne-Apel't reaction, and other laboratory tests. At this stage of the disease the patients are dangerous to the surrounding people since the disease can be transmitted through non-venereal routes (dishes, domestic objects, kisses, cough, etc.). The third stage of syphilis is gummatous affection of the upper airways. After purulence, gummas heal to leave starlike scars.

*Treatment* of patients with syphilis of the larynx should be performed in stationary conditions at dermatovenereological hospitals and dispensaries.

*Scleroma of the larynx* is a local manifestation of the general infectious disease caused by the Fritsch-Volkovich bacillus.

Induration appears on the mucosa of the nasal cavity, nasopharynx, pharynx, larynx and trachea (in most cases in

this particular sequence) The induration shrinks spontaneously or after treatment, becomes flat, and converts into simple atrophic scars Chronic stenosis of the upper airways may develop at both stages (induration and cicatrization) The disease is especially grave if the process spreads over onto the trachea and the bronchi Scleroma is diagnosed by clinical examinations and laboratory tests (histological studies of the affected tissue, Boidet-Gengou reaction)

The patients undergo combined *therapy* consisting in massive antibiotic therapy (streptomycin or its analogues), mechanical removal or crushing of fresh indurations in the nose, pharynx, larynx and the trachea In the latter case this procedure is effected with the aid of a bronchoscope with one-step lavage of the bronchial tree by antibiotic solutions (containing lydase or chemotrypsin) Because of cicatrization, patients complain of dryness in the nose and the throat, and of crust formation, which requires special care from the nurse Breathing of the patient should be watched with special care and if any signs of stenosis develop, the physician should be informed, the patient should be given warm alkali-oil inhalation, and oil drops should be instilled into the nose 3-4 times a day Oil solutions should obligatory be administered before night sleep into the larynx and the trachea In cases with stenosis, tracheotomy or laryngotracheostomy should be performed and further medicinal manipulations should then be carried out through the laryngotracheostoma

### Intubation, Tracheotomy, and Their Complications. Preoperative Treatment, Postoperative Care and Management of Patients

Irrespective of the cause, stenosis of the larynx would be classified as compensated, subcompensated, decompensated, and the state of asphyxia

In accordance with gravity of stenosis, conservative or surgical treatment is prescribed

Subcompensated and decompensated stenoses are treated in stationary hospital conditions and the therapy begins with conservative treatment

Anti-inflammatory preparations (antibiotics, sulpha drugs) and anti-oedema preparations are given along with hot feet

baths, warm compresses, or mustard plasters on the neck. If the condition of the patient continues aggravating, medicamentous tracheotomy is used (intramuscular administration of 1 ml of a 3% prednisolone hydrochloride solution or intravenous drip infusion of 30 ml of prednisolone in 200 ml of isotonic sodium chloride solution).

*Intubation* (insertion of special tubes into the larynx) may be used in stenosis of the larynx of any aetiology if the patient's life is endangered by asphyxia. Tracheotomy can also be used to restore respiration through natural airways. Intubation is normally used in children with transient stenosis (e.g. in infectious diseases and false croup). At the present time, a wide network of resuscitation departments is in effect at medical institutions, and the classical version of intubation described below is used in rare cases. Urgent intubation is done in most cases with medicamentous means, modern intubation tubes, and special apparatus that are used to control patient's respiratory and cardiovascular functions.

Operations to be performed by a medical nurse during resuscitation of patients will be described below.

Intubation is performed with special tools comprising a mouth gag, several tubes of various diameters, an intubator, and an extubator. The tools should be sterilized by boiling. The operation is performed as follows: the child is wrapped tightly in a sheet and seated in the laps of the nurse, an assistant immobilizes the child's head (anaesthetics are not used). The mouth of the child is widened by a gag inserted at the mouth angle. The surgeon introduces his finger into the mouth, feels the epiglottis, displaces it toward the tongue root, and inserts an intubator into the vocal slit along the finger. A funnel-shaped tube is attached to the end of the intubator. Two silk threads leading to the tube remain outside the mouth cavity and are attached to the patient's cheek by an adhesive tape. Treatment of the main disease is performed along with this manipulation.

An *extubation* is attempted in 24 hours: the tube is pulled out by the silk threads or using an extubator. If the breath of the child is inadequate, the tube is inserted into the larynx again. In any case the tube shall not remain for more than *three days* because grave complications may develop and tracheotomy will become necessary.

Intubated patients require special care on the part of the physician and the other medical personnel. The lumen of the tube may be clogged by films, crusts, or thick viscous mucus or sputum. The physician should then be urgently summoned who will replace the tube. The silk thread may be detached and the tube may then drop into the trachea or the oesophagus. In the former case it can be removed by tracheotomy. If the tube falls into the oesophagus and further into the stomach, it will safely pass the alimentary tract and be excreted. A serious complication is formation of sores and ankylosis of the laryngeal cartilage. This leads to chronic stenosis which will require multi-stepped surgical treatment. Another serious complication is aspirational pneumonia that may attend the process, strict control of the patient's respiratory system is therefore required. The nurse should be attentive to all complaints of the patient (cough, pains in the chest, appearance of sputum, body temperature, etc.) and carry out all prescriptions of the physician.

*Tracheotomy* is the incision of the trachea with insertion into the operation hole of a tracheotomic tube. This operation would be usually done in urgent cases with stenosis of the larynx and in grave general injuries in order to control the patient's respiration. But the operation can also be done to patients with chronic stenosis of the larynx and the trachea. If the opening in the trachea is made above the thyroid isthmus, this is called superior tracheotomy (which corresponds to one or two rings of the trachea), the inferior tracheotomy is made below the isthmus of the thyroid (at the level of the 3rd or 4th ring of the trachea).

Tracheotomy is carried out with local infiltration anaesthesia (0.5% or 1% procaine hydrochloride solution containing 0.1% adrenaline hydrochloride solution). The patient is in the lying position. Since asphyxia develops suddenly, sterile tracheotomy tools and materials should always be kept ready for use at each otorhinolaryngological department and every nurse should know where these tools and materials are located (Fig. 88).

After treating the skin of the neck with alcohol, iodine and after giving anaesthetics, the skin and subcutaneous connective tissue of the neck are incised along the median line, from the sternal notch to the inferior edge of the thyroid cartilage.

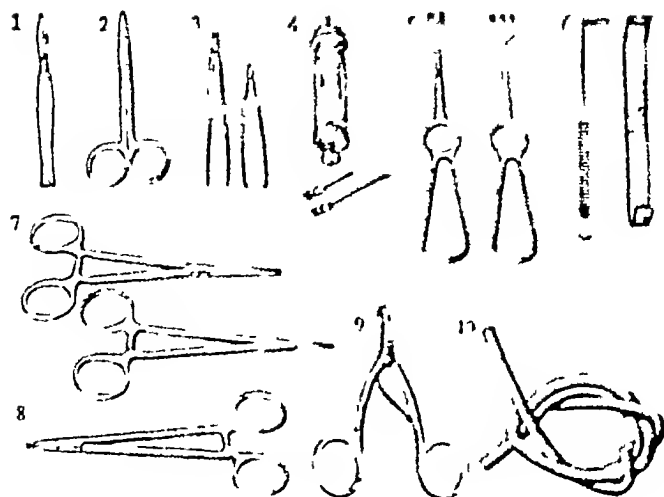


Fig. 88. Tracheotomy tools.

1—scalpel, 2—scissors, 3—forceps, 4—syringe and a long needle, 5—sharp hooks, 6—blunt hooks, 7—hemostatic forceps, 8—needle holder, 9—wound retractor, 10—aspiration tube.

The straight muscles of the neck are separated at the median line to expose the isthmus of the thyroid. The isthmus is displaced upward or downward, depending on whether tracheotomy is inferior or superior. An injection of 1-1.5 ml of 1-2% dicaine hydrochloride or 5-10% cocaine should be made into the trachea lumen. This is necessary to suppress the coughing reflex which develops when the lumen of the trachea is opened. One or two rings of the trachea are cut cross-wise. The wound is separated by a Trousseau retractor, and a tracheotomic tube is inserted into the trachea. Tubes of several types are used in modern medical practice: metal tubes, plastic (teflon) tubes, and elastic tubes with expanding rubber cuffs (Fig. 89). Plastic tubes should be preferred since they are lighter, less subject to corrosion under the effect of body fluids and wound exudate, and can easily be cleaned of crusts or thick mucus.

A tracheotomic tube consists of the body, an insert, and a flange provided with loops by which the tube is held in position on the neck of the patient. The insert is fixed to the flange by a special lock which holds the insert in place during coughing.

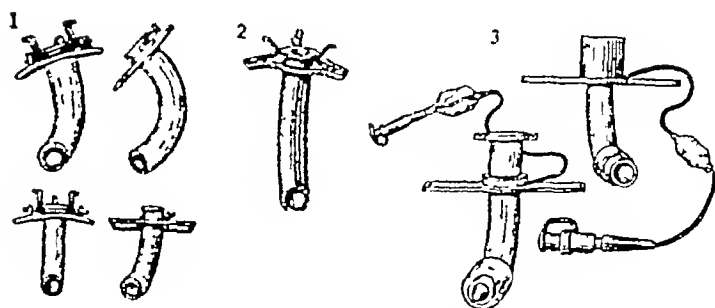


Fig 89 Tracheostomic tubes

1—teflon tube, 2—stainless steel tube, 3—thermolabile plastic tubes with inflating cuffs

A medical nurse should be well acquainted with the main types of tracheostomic tubes and be able to disassemble and assemble them during washing and sterilization. She should be able to remove quickly and carefully the insert directly on the patient, as her skill is improved, she may renew the tracheostomic tube completely.

Care of a tracheotomized patient includes a strict watch of his respiration because the tube may be clogged with pus, blood clots or thick mucus, and will require an urgent medical aid from the nurse. The nurse should remove the insert and make sure that the patient can freely breathe without it, if otherwise, the tube should be replaced by another one (normally done by a physician).

The nurse should also instill systematically (as prescribed by the physician) a dilute soda solution, oil drops, or other substances (chemotrypsin, etc.) into the tube to thin the sputum.

Gauze pads, that protect the wound and the surrounding area from contamination, should be renewed regularly.

Falling out of the tube from the stoma is a serious event that may occur after tracheotomy. If the nurse fails to restore the tube in its place at first attempt, she should insert a Killian nasal speculum or a Trousseau retractor into the wound before the physician comes to give skilled aid to the patient. Subcutaneous emphysema may develop immediately after operation due to inflation of subcutaneous tissues with exhaled air. The neck will then swell significantly and will pro-

duce crackling sounds on palpation. This complication rarely requires an urgent aid of the physician.

During recent years many surgical and therapeutic methods are used in resuscitation practice in this country and abroad. Resuscitation posts or departments are equipped with all means that might be necessary to give urgent aid to patients whose life is in danger. These means include oxygen (that will be given by specially trained medical personnel), apparatus for controlled (artificial) respiration, special diagnostic and therapeutic equipment.

Most resuscitation measures aimed at recovery of the patient from the state of clinical death begin with intubation, i.e. insertion of a tube into the trachea in order to ensure oxygen supply to the lungs.

The first resuscitation measures are taken directly at the spot where the patient is found by medical workers. Urgent intubation is performed mostly in cases with respiratory insufficiency or a sudden fall in the cardiovascular or respiratory function.

The role of a medical nurse during resuscitation is very important and she will be unable to give the necessary aid unless specially trained.

Intubation is one of the main resuscitation procedures. It may be done through natural airways or through an operatively made opening (tracheostoma).

Special apparatus and tools are required for intubation. These are made ready for use by an anaesthesiological (reanimatological) nurse and a physician-anaesthesiologist. The nurse prepares and sterilizes a blood transfusion system and apparatus for infusion of other medicinal substances, she prepares several syringes and needles for intravenous injections, a tourniquet, a tonometer with a cuff that should be attached to the arm of the patient during the entire operation. The nurse sterilizes intubation tubes of several types and sizes in three solutions. The diameter of the tubes varies from 4 to 15 mm, which corresponds to numbers from 1 to 10. The tubes are normally made from red rubber, but in recent years, this is replaced by special thermolabile plastics. When heated to the temperature of the human body, a tube made of thermolabile plastic becomes soft and elastic to

prevent undue injury to the tissues and mucosa of the larynx and the trachea. Most tubes are provided with thin-walled expanding cuffs, located 1-1.5 cm from the distal end of the tube. It is provided with a rubber tubing passing along the main tube and supplied with a rubber bulb and a plug at the end. As soon as the tube is inserted into the trachea, the rubber cuff may be inflated with air from a 10-ml syringe to preclude penetration of blood or the stomach (mouth, oesophagus) contents into the airways.

In order to prevent obstruction of tubes at points of bending, they are reinforced with a metal or plastic spiral which makes the framework of the tube which is coated on the outside with a thin layer of rubber or plastic.

If the patient is unconscious, no special anaesthesia is necessary for intubation. If the patient is conscious, a dropper for constant intravenous infusion of medicinal substances should be installed before intubation. The patient is narcotized through the dropper (he is anaesthetized and given substances paralyzing his muscular activity).

After the necessary medicinal preparations are given to the patient he should be intubated immediately and his respiration should be controlled artificially since spontaneous breathing stops because of paralysis of the respiratory muscles. Intubation is performed with the aid of a laryngoscope consisting of a body, that houses a power pack, and a spatula provided with an electric lamp on its lateral surface. A guide for intubation tubes, a tongue holder, forceps with special gauze for removal of mucus and saliva from the mouth, and the necessary medicines should be at hand of the anaesthesiological nurse.

It should be remembered that even sparing intubation and a properly inflated cuff will injure the mucosa of the larynx and the trachea. This may become the cause of subsequent ulceration and inflammation of the laryngeal and tracheal cartilages and cicatricial stenosis of their lumen. Translaryngeal intubation should not therefore last longer than 48 hours. During this time the nurse should release air from the inflated cuff from time to time. The intubation tube should be moved 1-2 cm up or down and the cuff inflated again in 3-5 minutes.



If the intubation remains necessary for more than two days, a tracheostoma should be made and further intubation should be performed through this opening

### *Review Questions*

- 48 What forms of croup do you know?
- 49 What tools should obligatory be present in the department where false croup patients are treated?
- 50 How are laryngeal stenoses classified?
- 51 How is chronic laryngeal stenosis treated? Conservatively or surgically?
- 52 How are laryngeal tumours classified?
- 53 By what examinations can a diagnosis of laryngeal tumour be established? Will it be by mere inspection or x-ray examination, histological examination of a biopsy specimen?
- 54 How are stenoses classified with respect to respiratory insufficiency?
- 55 What is tracheotomy?

### FOREIGN BODIES OF THE LARYNX, TRACHEA, AND OESOPHAGUS

Various foreign objects may penetrate the larynx, trachea and bronchi. As a rule these objects get into the airways when a person holds an object (a pin, needle, button, small coin) or food (large lumps or firm lump of food, a bone, etc.) in the mouth and then suddenly utters an exclamation or begins laughing. Foreign objects may also penetrate respiratory or alimentary tracts during a surgical intervention on a narcotized patient.

Large foreign objects or bodies with sharp edges would be usually stopped in the larynx. When a large object obstructs the larynx, asphyxia develops due to a spasmodic constriction of the vocal slit. A person may die from suffocation in a few seconds. An urgent tracheotomy or direct laryngoscopy (with extraction of the foreign body by long forceps) is required to save the victim. A heavy blow in the region between the shoulder blades will sometimes help as well.

If a small object with sharp edges gets in the larynx the patient feels pain and the presence of the interfering body in-

side the throat, he begins coughing and blood may be traced in the sputum. Removal of the foreign object will then require local anaesthesia (less frequently narcotization) and direct (or indirect) laryngoscopy (see 'Examination of the Larynx, Trachea, and Cervical Oesophagus')

If a foreign body passes the vocal slit, it penetrates either the trachea or bronchi. Larger foreign bodies (of irregular shapes in particular) will be held at the point of the tracheal bifurcation. As air is inhaled or exhaled, it moves the foreign object in the trachea to cause fits of cough, the feeling of pressure and pain in the chest. (In rare cases the pressure of air during spasmodic coughing may expel the foreign object, but normally the patient can only be relieved by tracheotomy.)

Sometimes a foreign body (especially a round one) sinks to reach lower portions of the bronchi until it penetrates one of them. This may cause complete obstruction of the bronchus and dysfunction of part of the lung (atelectasis).

Respiratory insufficiency, pains in the chest and the back develop gradually. If the foreign body is displaced periodically, the victim coughs in fits. The object will only be removed by bronchotracheoscopy. The operation is not simple, because foreign body is difficult to visualize even with X-rays.

It should be remembered that foreign bodies of the larynx, trachea and bronchi endanger the life of the victim even if the clinical picture is not vivid. Therefore, if a suspicion arises that a foreign body might penetrate the respiratory tract, the patient should be delivered to an otorhinolaryngological department.

Foreign bodies get into the oesophagus mainly during meal. These may be smaller fish bones, chick or other bones. Various objects are found in children. Small toys are sometimes swallowed by children. Pain in the throat, beyond the sternum, or beneath the shoulder blade, difficult (or obstructed) swallowing of liquid and food are symptoms of foreign bodies in the oesophagus. Oesophagoscopy is used to remove foreign bodies from the oesophagus.

A victim shall never be advised to push the foreign object further in the oesophagus by swallowing coarse food, because it may aggravate the situation and even cause rupture of the oesophagus.

*Answers to Review Questions*

- 37 Epiglottis, epiglottic folds, posterior portions of cartilages
- 38 Cartilaginous structure, ligaments, mucosa-lined inner laryngeal muscles, outer laryngeal muscles
- 39 Thyroid, cricoid and arytenoid cartilages
- 40 Inferior edge of the cricoid cartilage
- 41 At the level of the 5th cervical vertebra
- 42 Respiratory, protective (separating) and voice-forming
- 43 Mucosa-lined vocal muscles
- 44 Direct, indirect, and instrumental methods
- 45 Direct laryngotracheoesophagoscopy with fibre optics
- 46 Direct inspection of the larynx or using a special microscope
- 47 (1), (2)
- 48 Diphtheritic and false croup
- 49 A tracheotomy tool kit
- 50 Acute and chronic
- 51 Treatment of chronic stenoses of the larynx by multi-step surgery
- 52 Benign (fibroma, angiofibroma, polyps, cysts) and malignant (cancer, sarcoma)
- 53 Histological examination of biopsy specimen
- 54 Compensated, subcompensated, decompensated, and the state of asphyxia
- 55 Incision of the trachea with insertion of a tracheotomic tube into the artificial opening

## Chapter 4

### Diseases of the Ear

#### ANATOMY AND PHYSIOLOGY OF THE ORGAN OF HEARING

The organ of hearing is located on the lateral surface and in the depth of the temporal bone. It consists of the following three main parts: the external, the middle, and the internal ear.

The *external ear* includes the auricle and the external acoustic meatus. The external ear is separated from the middle ear by a tympanic membrane (ear drum). The outer surface of the tympanic membrane is thus the part of the external ear while its inner portion belongs to the middle ear (Fig. 90). The framework of the auricle is hyaline cartilage of intricate shape which determines the configuration of the external ear. The skin overlying the cartilage is very thin and fits tightly the perichondrium. Subcutaneous connective tissue is almost absent. The following structures of the auricle

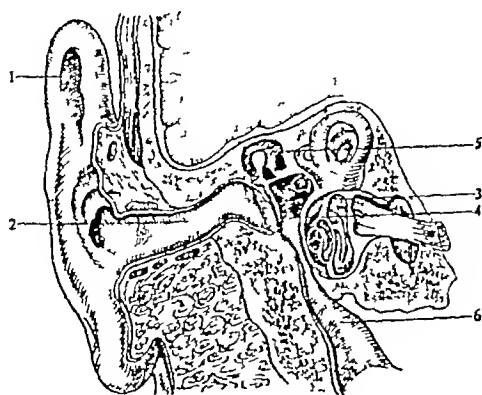


Fig. 90 The organ of hearing

1—auricle, 2—external acoustic meatus, 3—tympanic membrane,  
4—tympanic cavity, 5—ossicles, 6—auditory (eustachian) tube

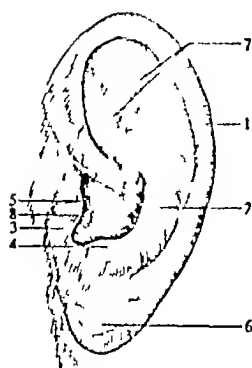


Fig 91 Auricle

1—helix, 2—anthelix, 3—tragus, 4—antitragus, 5—concha, 6—lobule, 7—crus of the anthelix, 8—acoustic meatus

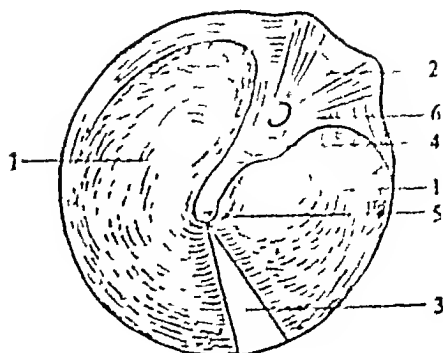


Fig 92 Tympanic membrane

1—pars tensa, 2—pars flaccida, 3—cone of light, 4—manubrium of the malleus, 5—umbo, 6—malleolar prominence

are distinguished (Fig 91) the helix, the lobule, the external acoustic meatus, the anthelix, the tragus and the antitragus

The *external acoustic meatus* is lined with thin skin containing sebaceous and ceruminous glands. The external meatus extends into the head to a length of 3.5 cm. It consists of a cartilage which is continuous with the cartilage of the auricle and a portion that passes through the temporal bone.

The *tympanic membrane* (drum of the ear) is the first element of the sound-conducting apparatus of the middle ear. It consists of three layers: a thin layer of epidermis, found on the side of the acoustic meatus; the central layer of connective (fibrous) tissue consisting of circular and radial fibre bundles; the inner layer of the tympanic membrane, lined with mucosa. The tympanic membrane consists of two portions, pars tensa and pars flaccida. The following landmarks can be distinguished on the tympanic membrane during its inspection with a head mirror and a speculum: its upper portion has a malleolar prominence, the central portion of the membrane is slightly depressed (attached to the malleolar process, this is also called umbo of the tympanic membrane), and the lower portion has a lustrous sector, the cone of light, found inferiorly and anteriorly to the umbo of the tympanic

membrane (Fig 92) These landmarks undergo significant changes in various pathological processes of the external and the middle ear The auricle is a rudimentary organ but it has its own function location of the source of sound The curved shape of the acoustic meatus protects the tympanic membrane and the middle ear from mechanical and acoustic injury

The *middle ear* includes the tympanic cavity (the cavity of the middle ear) which is communicated with the pharynx through the auditory tube, the antrum, and the cells of the mastoid process intercommunicated between themselves and the antrum

The *tympanic cavity* is an irregular cube, in which the outer wall is the tympanic membrane, the upper wall borders with the middle cranial fossa, and the lower with the bulb of the jugular vein (and the capsule of the mandible joint) The posterior wall of the tympanic cavity (its upper portions) has an opening leading to the antrum The medial wall of the tympanic cavity is the boundary structure between the middle and the inner ear This wall has an intricate relief It has a fovea of the oval window, which accommodates the footplate of the stapes and the niche of the round window inside which there is a connective-tissue membrane separating the middle and the inner ears There is a promontory between the windows This is the prominence of the main coil of the cochlea (inner ear)

The tympanic cavity (between the tympanic membrane and the niche of the oval window) has the auditory ossicles, viz, the hammer (malleus), the anvil (incus), and the stirrup (stapes) The hammer consists of a club-shaped head, the neck and the handle The latter is continuous with the tympanic membrane while the head articulates with the anvil It also has a long process which is connected with the head of the stapes Moreover, the tympanic cavity has two muscles, viz, the tensor tympani muscle and the muscle of the stapes These muscles control the amplitude of movements of the auditory ossicles The sound wave passes the external meatus and causes the tympanic membrane to vibrate The vibrations are transmitted to the hammer, further to the other ossicles and finally to the footplate of the stapes and the fluids of the inner ear (Fig 93)

The *auditory (eustachian) tube* comprises two portions,

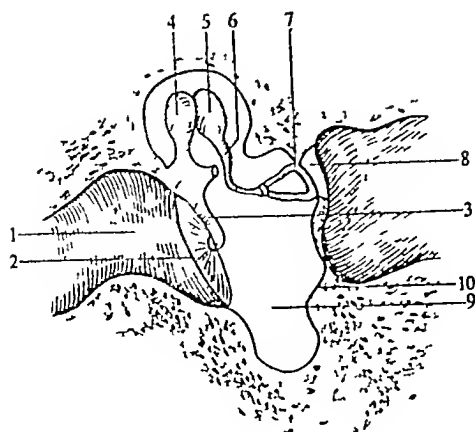


Fig 93 Tympanic cavity

1—acoustic meatus, 2—tympanic membrane, 3—manubrium of the malleus, 4—head of the malleus, 5—anvil (incus), 6—long process of the anvil, 7—stapes, 8—oval (vestibular) window 9—tympanic cavity, 10—round window

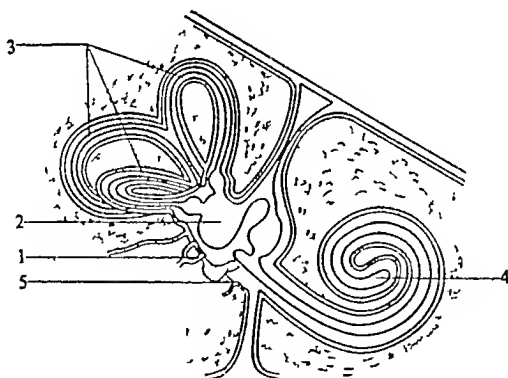


Fig 94 Internal ear

1—oval window, 2—vestibule, 3—semicircular canals, 4—cochlea, 5—round window

namely, the bony one (pars ossea) located in the tympanic cavity bone, and a cartilaginous portion (pars cartilaginea) that ends in the nasopharynx. The auditory tube ensures ventilation of the tympanic cavity and also gives outlet to exudate during inflammation of the middle ear.

The auditory ossicles are located in the uppermost portion of the tympanic cavity whose posterior wall is continuous with the mastoid cell (mastoid antrum). The antrum borders with air cells of the temporal bone. Depending on the size and amount of air cells, pneumatic, diploetic and sclerotic temporal bones are differentiated. (Diploetic bones are actually a loose osseous tissue, and sclerotic bones consist of hard tissue.) The degree to which a bone is pneumatic bears its effect on incidence of chronic inflammatory diseases of the middle ear.

The *inner ear (labyrinth)* is located in the depth of the temporal bone and comprises the main three departments: vestibule, cochlea, and semicircular canals. The outer wall of the labyrinth is a hard bone with two openings establishing communication with the middle ear. These are the round and oval windows. The osseous labyrinth contains the fluid known as perilymph and the membranous labyrinth comprising the auditory and vestibular receptors (Fig. 94).

The *vestibule of the labyrinth* consists of two sacs inside which the otolithic apparatus (part of the vestibular analyzer) is located. Three semicircular canals (the anterior, posterior and lateral) open into the vestibule. Each canal has a wider portion, the ampulla, where the receptors of the vestibular nerve are located.

The *vestibular analyzer*, together with the cerebellum and other systems of the brain, regulate the muscular tone, give the sense of balance and orientation in space.

The *cochlea* is a spiral osseous canal (2.5 turns) whose base is located beneath the lateral wall of the tympanic cavity. There is an osseous spiral plate inside the cochlea on which, like on the ladder, the spiral canal (the cochlear duct) is located. The spiral canal of the cochlea is filled with the fluid called endolymph. The main membrane, which is continuous with the spiral plate, bears the auditory analyzer, the spiral (Corti's) organ, where the mechanical energy of vibrations transmitted through the endolymph is converted into a nerve impulse which is transmitted to the brain and perceived as sound. The auditory and the vestibular nerves are joined into one trunk in the inner ear.

It is necessary to remember that the facial nerve passes through the temporal bone into the niche of the oval window,



therefore it may be involved in the inflammatory process during middle otitis (acute or chronic) and paralyzed

*Blood supply* of the external and middle ear is derived mainly from the external carotid artery system and partly from the inner carotid artery. The venous blood is drained through a system of jugular veins. A large venous collector, the sigmoid sinus, is located posteriorly to the mastoid process, on the inner surface of the cranium.

The external and middle ears are *innervated* by the system of the trigeminal nerve, superior cervical plexus, the nervus vagus and the sympathetic nerves.

### Examination of the Organ of Hearing Main Tools and Apparatus

The main method of examination of the organ of hearing is otoscopy. A head mirror (Simanovsky) and aural specula (sizes vary from the narrowest No. 1 to the widest No. 6) are used for otoscopy. Ear specula should not be used for inspection of infants, for convenience of inspection the auricle should be pulled posteroinferiorly, and the tragus anteriorly. For otoscopy the patient should be seated in a chair to the left of the source of light. The nurse should prepare all necessary tools for inspection (which should be sterilized by boil-

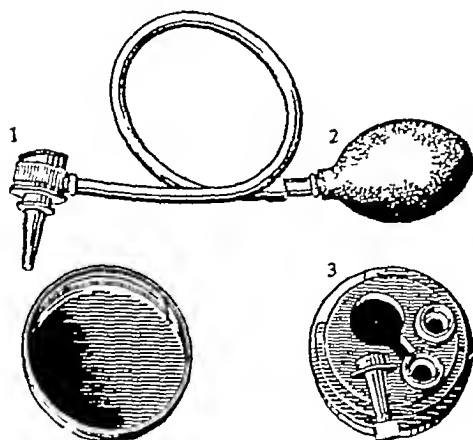


Fig. 95 Siegle's otoscope  
1—optical system, 2—rubber bulb, 3—changeable specula



Fig 96 Otoscopy with an operating microscope

ing) The procedure is as follows the patient faces the physician, who pulls the patient's left auricle posteroinferiorly by the right hand and uses his left hand to introduce carefully the ear speculum into the meatus to the depth of its cartilaginous portion. If an infant is inspected, it should be seated in the laps of the nurse who immobilizes the infant's extremities. Another nurse should hold the infant's head. A Siegle otoscope is sometimes used for a detailed inspection of the ear. It incorporates an optical and a pneumatic

system which help observe a magnified image of the tympanic membrane under varying pressure in the acoustic meatus (Fig 95)

An operating microscope (Fig 96) is also widely used in otoscopy

### *Review Questions*

- 56 Name the anatomical structures of the organ of hearing
- 57 Name the main anatomical structures of the external ear
- 58 What are the main anatomical structures of the auricle?
- 59 What are the main anatomical structures of the middle ear?
- 60 Name the auditory ossicles in the order of their actuation
- 61 Name the landmarks of the tympanic membrane used in otoscopy
- 62 Name the main structures of the inner ear
- 63 Where are receptors of the vestibular nerve located?
- 64 Where is the auditory analyzer located? What is its name?
- 65 What fluids fill the inner ear?
- 66 What is the main method of inspection of the ear?
- 67 What apparatus is used for optical otoscopy?

### **Examination of the Auditory and Vestibular Function**

Whisper, normal voice, tuning forks, tonal and speech audiometry are used in the study of the auditory function. The hearing function in children is tested at play.

Correct audiometry with whisper and normal speech should be carried out in a room not shorter than eight metres and isolated sufficiently well from extraneous noise. The patient is turned with the tested ear to the physician (in the end of the room) and the nurse closes tightly the other ear by pressing the tragus to the external meatus. The set of words used in audiometric tests includes low and high pitch tones. The hearing function is normal if the patient perceives speech at a distance over 20 m and whisper not less than six metres.

A set of four tuning forks ( $C_{128}$ ,  $C_{512}$ ,  $C_{1024}$ , and  $C_{4000}$ ) is used for testing the hearing function. Using a stopwatch,



Fig 97 Taking an audiogram

the examiner determines the time during which the tuning fork can be heard with air conduction (the fork is brought to the external acoustic meatus) and with bone conduction (the fork is pressed to the mastoid process behind the auricle). Hearing tests (Weber, Rinne, Schwabach) are used to assess the degree of hearing loss, and to differentiate between affections of the sound-conducting apparatus of the outer and middle ear from the affection of the sound-perceiving apparatus in the cochlea. A special apparatus is used to rule out over-hearing of the sound by an intact ear.

Tonal threshold audiometry is now mostly used to test the sense of hearing. A special apparatus, audiometer, is used for the purpose. The apparatus is operated by a specially trained audiometrist.

An audiometer comprises an attenuator (the apparatus generating sounds of various frequencies and strength), two pairs of headphones (for testing sound conduction by air and bone) and a button which the patient presses when he perceives the sound (Fig 97). A special chart, audiogram, is used to make a graph showing the hearing ability of the

patient, where the pitch of the tone (in cycles per second) is recorded against the axis of abscissas, and the strength of the sound (in decibels) is plotted against the axis of ordinates. Each ear is tested separately for air and bone conduction and the results are marked on the graph by circles for the right ear and crosses for the left ear. Bone conduction is designated by a broken line and air conduction by a continuous line. If the lines showing air and bone conduction fall simultaneously, this indicates the affection of the internal ear (neuritis of the auditory nerves), if air conduction is low while the bone conduction remains normal, the sound-conducting apparatus is impaired.

Perception of speech may also be tested by electronic apparatus in a specially insulated chamber.

If it is difficult to establish a speech communication with an infant, its hearing function may be tested at play.

The vestibular function is tested by statokinetic, caloric, and rotative tests.

Statokinetic tests include finger-to-finger and finger-nose tests, test for adiadochokinesia, station test, etc., and also the study of the patient's gait. These tests help establish a differentiated diagnosis of the diseases of the labyrinth from affections of the cerebellar and other vessels and the central nervous system.

The rotative test is used to assess excitability of the vestibular system. The patient is seated in a rotating chair (Bárány's chair), directed to close the eyes and lower the head about  $30^\circ$  anteriorly. The physician, or a specially instructed nurse, rotates the patient in the chair through ten complete turns within twenty seconds. The chair is then stopped and the patient is directed to straighten and open the eyes. Rotation causes the perilymph to move in the semicircular canals, this excites the labyrinths and the patient sways in the chair in the direction of rotation, nystagmus develops in the patient. The eyeball rhythmically moves involuntarily. The duration of nystagmus and its character (horizontal, vertical, rotatory, etc.) are used to assess the function of the vestibular apparatus.

The caloric test (Bárány's symptom) is carried out by irrigating the external acoustic meatus with warm and cold water. The changes in the temperature of water are transmit-

ted from the external meatus to the labyrinth to cause nystagmus

The rotative test causes disturbances in both labyrinths, while the caloric test is used to test the labyrinths separately. The diseases of the vestibular apparatus (labyrinthitis) are manifested by vertigo of various intensity (from light swaying during walking to grave conditions when the patient cannot leave his bed or even raise his head from the pillow)

### *Review Questions*

- 68 What are the main methods by which the sense of hearing may be tested?
- 69 Name the main methods by which the vestibular function may be tested

## **Treatment and Care of Patients with Diseases of the Organ of Hearing**

### *Medicamentous Treatment*

Special knowledge and skill are required on the part of a nurse to take care of patients with the diseases of the ear. An otorhinolaryngological nurse should be able to carry out otoscopy, i.e. to make use of a head mirror and to perform manipulations in the external acoustic meatus. The main manipulations in the treatment of inflammatory diseases of the ear are toilet of the external ear, instillation of drops into the ear, insertion of turundae, and application of ointments. Toilet of the external ear includes sparing (but thorough) cleaning of pathological materials such as pus, mucus, blood, etc. A special probe with a serrated end is used to cleanse the meatus. The probe should be sterile. To that end it should be boiled or kept constantly in an antiseptic solution. A small piece of sterile hygroscopic cotton wool is wound round the serrated working end of the probe so that it might be soft. All pathological contents should be carefully and thoroughly removed from the acoustic meatus (under visual control). It should be remembered that application of medicinal preparations will only be efficacious after a thorough cleansing of the meatus. The external ear of neonates or infants should be

cleaned by cotton wool twisted into a dense wick with a soft brush at the end. The wick should be wetted in vaseline oil and inserted carefully into the meatus by slightly rotating it until it reaches the ear drum. Drops are instilled into the ear of a patient in the lying position (on the side of the intact ear). The drops should be warmed to the temperature of the human body and instilled by an ophthalmological pipette. The medicinal preparation should not be instilled straight into the lumen of the meatus but rather on its lateral wall since otherwise an air bubble may be formed over the tympanic membrane and the medicine will not contact the affected site.

Ointments should also be applied only after a thorough cleaning of the ear with cotton wool. The ointment should be placed on cotton wool, into which the probe is wrapped, and the walls of the meatus and the tympanic membrane treated with the ointment. Semi-alcohol compresses are recommended in some acute inflammations of the external and middle ears. To that end a turunda wetted in a 3% boric alcohol is inserted into the meatus by pincers and a few gauze napkins wetted in a 50% alcohol solution are placed on top of the ear or the area behind the ear. A sheet of waxed paper and a thick layer of cotton wool are placed atop and the whole compress is fixed by bandaging. The compress should remain on the ear for 3-4 hours.

Powdered medicinal preparations or their mixtures may also be blown into the external and middle ear through perforation in the tympanic membrane. The manipulation is carried out with a visual control using an ear speculum and a special apparatus known as insufflator.

Insufflation of powdered medicines should also be preceded by a thorough cleaning of the acoustic meatus. It is necessary that the powder should not be insufflated in a dense jet but be dispersed in a cloud.

**Ear inflation according to Politzer (politzerization)** Inflation of the middle ear through the eustachian tubes is an important manipulation in many diseases of the middle ear, in adhesive otitis, sequelae of acute otitis, chronic purulent perforative otitis, eustachitis, and after radical operations on the middle ear. Politzerization is performed with a rubber bag supplied with a 30-35 cm long tube ending in an olive

The patient is seated in a chair and a physician or a nurse stands in front of the patient. The olive is inserted into the nose of the patient, the other nostril is pressed by the fingers of the left hand. The patient is directed to utter (loudly and distinctly) 'one, two, three' (or a three-syllable word with an accent at the third syllable), and as the patient utters 'three', the bag should be energetically squeezed. If the procedure is performed correctly, the patient feels a clap in one or both ears.

Politzerization is contraindicated in acute rhinitis and exacerbated chronic rhinitis or sinusitis, since infection can be blown into the middle ear.

#### REMOVAL OF EARWAX AND FOREIGN BODIES

Accumulation of earwax (cerumen) in the external acoustic meatus may often impair the hearing function. Certain anatomical characteristics of the ear (bends in the meatus, the presence of exostoses, ample hair, etc.) may favour accumulation of the earwax in the osseous portion of the meatus. The patient does not feel impairment of the hearing function until the meatus is completely obstructed by the earwax. Therefore patients often complain of a sudden hearing loss (after a head wash, or after an attempt to clear the meatus, etc.). Earwax shall be removed by irrigation. It is not recommended to use forceps or a metal hook, because earwax comes in tight contact with the tympanic membrane and a metal object may injure it.

The irrigation is performed by a nurse, using a warm antiseptic solution and a syringe. The procedure is as follows. The patient's shoulder is covered with a towel to protect the clothes from spoiling, and a curved (kidney-shaped) basin is pressed tightly to the neck a few centimeters below the auricle. The end of the syringe is brought (under visual control) into the cartilaginous portion of the acoustic meatus and the antiseptic liquid expressed from the syringe at an angle to the posterosuperior wall of the acoustic meatus (not along the central axis). The auricle should at this moment be pulled posteriorly and superiorly. The liquid should be expressed by impulses (not in a continuous jet). If earwax is dry and dense



and contains epidermal inclusions, the patient is recommended to instill a 3% hydrogen peroxide solution into the ear three or four times a day in the course of three or four days. From two to three syringes of antiseptic solution will then be required to clean the ear from the wax. The remaining liquid will be removed from the meatus by cotton wool. Irrigation is contraindicated to patients with dry perforation of the tympanic membrane.

*Foreign bodies* of the external acoustic meatus would usually be found in the ear of children. These are usually pieces of paper, beans, cereals, etc. Small insects often penetrate the acoustic meatus and their motion on the surface of the tympanic membrane gives unpleasant sensations. Before a physician examines the patient, the nurse (or the patient himself) may instill pure water or any vegetable oil into the ear. As a rule, penetration of a foreign body into the external acoustic meatus is attended with pain or the sense of discomfort and impairment of hearing, but in some cases the presence of a foreign body in the ear may remain symptomless for a considerable time and will only be revealed on medical examination.

Foreign objects shall be removed from the acoustic meatus by a *physician*. A nurse will only assist. Various methods are used depending on the size of a foreign object, or how it is held inside the meatus. As a rule an attempt is first made to remove it by irrigation with a syringe (as in removal of earwax). If it fails, a special hook may be used. The physician passes it between the foreign body and the wall of the meatus, then turns to engage the foreign body, and pulls out. Round and tightly fitting objects may not be attempted to remove by forceps because the body will slip off the branches and may progress further into the meatus. This may cause rupture of the tympanic membrane.

A nurse irrigates the ear, gives the necessary tools to the physician and holds the patient's head tightly because manipulations in the ear may be rather painful and the tympanic membrane (or even structures of the middle ear) may be injured if the patient jerks.

Fixation of children is especially important. A child may be immobilized by wrapping in a bed sheet and placing in the nurse's laps who holds tight the child's legs between her

thighs and uses her arms to hold the child's arms and the head (which should be pressed tight against the nurse's chest)

If a foreign body fits very tightly the acoustic meatus, the manipulation may require narcotization of the patient. In some cases a foreign body may be only removed from the ear by operation.

If a foreign object of the ear can swell by absorbing moisture (e.g. beans), instillation of a 91° alcohol is recommended. The alcohol will absorb moisture from the object, which will shrink and its removal will thus be facilitated.

If the walls of the acoustic meatus or the tympanic membrane were not damaged during removal of the foreign body, the patient may be released from the hospital.

#### ACUTE AND CHRONIC EXTERNAL AND MIDDLE OTITIS

An acute inflammation of the skin of the external acoustic meatus may be either diffuse (external otitis) or local (furuncle).

*Acute external otitis* begins with the sense of itching and light pain. Serous or purulent exudate issues from the ear and pain intensifies, the hearing function may be impaired. The skin of the acoustic meatus inflames and erosion develops.

*Treatment of external otitis* first of all thorough toilet of the external acoustic meatus is required. A piece of cotton wool wound round an ear probe is used for the purpose. After pathological material is removed from the meatus, a thin layer of antiseptic ointment is applied to the skin (streptocide, synthomycin, yellow mercuric oxide ointment, etc). Powdered prednisolone (insufflation), hydrocortisone emulsion, and other hormonal preparations have a marked anti-inflammatory effect. Physical methods (U-V rays, UHF and microwave therapy) are also effective. If the acute disease is not treated properly it may transform into a chronic process. Pain in the ear will persist and exudate continues to discharge. Hearing may be impaired. Chronic process should be treated in the same way as the acute one but a stimulating therapy should also be given. Transfusion of autoblood (5 ml of blood is taken from the patient's vein on the first day, and the dose will then be increased 1 ml daily, to attain

10 ml at the end of the course) Antibiotics are added to the blood and the mixture injected intramuscularly Intramuscular injections of aloe, vitamin B preparations and physiotherapy are also indicated

*Furuncle* (local inflammation) of the acoustic meatus is characterized by sharp pain, especially when the tragus is pressed The skin of the meatus is very thin and subcutaneous connective tissue is almost absent At the same time this region is richly innervated Pain therefore often irradiates to the back of the head or the pharynx (the trigeminal nerve is involved) The body temperature may rise The patient should be given general and local treatment Analgesics (analgin, amidopyrine) and antibiotics should be prescribed UHF and microwaves are helpful Local treatment includes insertion of turundae with boric alcohol into the external acoustic meatus When the furuncle ruptures, the exudate should be removed thoroughly since otherwise pus may cause inflammation of the adjacent areas or furunculosis of the skin of the acoustic meatus In addition to the earlier local treatment, the patient should be given general stimulating therapy (vitamins, autoblood transfusion, antibiotics)

*Acute middle otitis* is an acute inflammation of the middle ear caused by infection that penetrates the tympanic cavity through the auditory tube It often develops with local or general chills or in asthenic patients (after influenza, tonsillitis, acute respiratory diseases, pneumonia, etc)

Acute otitis is marked by shooting or stabbing pains in the ear, deteriorated hearing, increased body temperature, weakness, etc Strong pains persist for 1-2 days and the patient then feels the rupture of the process in the ear Sanguineous, mucous, or purulent exudate appears from the acoustic meatus, pain subsides and the body temperature drops to subfebrile

An infant with acute otitis is restless, it cries, touches the diseased ear, and reacts to pain during palpation of the ear, signs of intoxication develop body temperature increases, stools become abnormal If acute otitis is not treated or treated incorrectly, it may transform into the chronic process and give complications Meningitis is one of the most serious complications of acute otitis

Acute middle otitis (catarrhal or perforative purulent)

shall be *treated* by antibiotics from the very first day of the disease (tetracyclins, 100 000 units six times a day for out-patients and 500 000 units of penicillin four times a day in stationary conditions of a hospital) Antibiotics should be given when pain in the ear subsides and the body temperature drops (i.e. in 2-3 days) and shall not be suspended before 6 or 7 days pass from the first day of the disease Premature suspension of intramuscular injections of antibiotics may cause relapse of the disease and its transformation into a subacute process with an exudative component, with subsequent transformation into adhesive (commissuro-cicatricial) process in the tympanic cavity Analgin or amidopyrine, 0.5-0.3 g tablets three times a day should be given or a 50% analgin solution should be injected in strong pains A turunda wetted in a 3% boric alcohol should be placed in the acoustic meatus two or three times a day If the patient is treated at home, a 3% boric acid solution should be dropped on the turunda in the ear Inflammatory exudate appears in the tympanic cavity during inflammation of the middle ear mucosa and it is therefore necessary to control the auditory tube function so that the exudate could be drained from the middle ear into the nasopharynx Vasoconstricting preparations (3% ephedrine solution with adrenaline, naphthyzine, halazoline, 4, 5 or 6 times a day) should therefore be instilled in the nose Semi-alcohol compress or a warming bandage should be applied to the diseased ear Wool kerchief should preferably be used for the purpose If a patient with acute otitis is treated at hospital, UHF and microwaves should be prescribed from the very first day of the disease Complex therapy with physiotherapeutic procedures usually abate the process and prevent the transition of catarrhal otitis into purulent perforative otitis, i.e. preclude purulent inflammation with destruction of a part of the tympanic membrane in the cavities of the middle ear If purulent perforative otitis develops the patient's acoustic meatus should also be cleaned with special care After the pathological material has been removed from the ear using cotton wool, the patient should be placed on the side of the intact ear and the medicinal preparation (a 3% boric alcohol, 1-2% solution of silver nitrate, freshly prepared solution of antibiotic) instilled into the diseased ear as instructed above

*Chronic purulent middle otitis* is marked by permanent or periodic discharge of pus from the ear, impaired hearing function, and pain or discomfort in the affected ear. The inflammatory process exacerbates from time to time (usually associated with acute chills) strong pains develop in the ear, purulent discharge from the ear becomes significant, the patient feels indisposition, weakness (body temperature sometimes rises). Otoscopy of the external acoustic meatus reveals purulent, seropurulent, or sanious exudate. The tympanic membrane is hyperaemic, the tympanic cavity mucosa (as observed through the perforation) is inflamed, and markedly thickened.

Chronic middle otitis may be *treated* conservatively or surgically. The latter treatment is normally used in complications of chronic otitis (see below). Treatment and care of patients with chronic middle otitis in remission includes thorough cleaning of the external acoustic meatus with subsequent instillation of sanating drops or insufflation of powdered medicines. The medical manipulations include irrigation of the middle ear cavities through the perforation in the tympanic membrane. A 3% solution of boric alcohol warmed to room temperature is normally used for irrigations. The medical nurse sterilizes a special cannula, syringe, and warms up the solution. During the entire time of irrigation the nurse stands by side of the patient because the patient may develop vertigo or faint.

Antibiotics and physiotherapeutic procedures are prescribed in addition to local treatment of exacerbated chronic purulent middle otitis.

Chronic purulent middle otitis may cause grave complications because osseous structures of the tympanic cavity are destroyed during chronic inflammation, especially so if cholesteatoma develops in the cavity of the middle ear. Cholesteatoma is an accumulation of epidermal mass which attacks surrounding osseous structures. Exacerbation of the inflammatory process, purulence of a cholesteatoma may cause penetration of pathogenic microbes in the adjacent vital intracranial anatomical structures. If cerebral membranes become thus involved, meningitis develops.

A vitally important vein, sigmoid sinus, passes in the posterior portions of the mastoid process. If the sigmoid sinus is

involved, a septic thrombus will be formed, and thrombosis of the sigmoid sinus will cause another grave complication, sepsis

Infection may penetrate the cavity of the cranium either through direct contact or may be carried with blood. This may cause abscess under the membranes, in the cerebral hemispheres, or in the cerebellum.

These severe complications can be prevented or treated surgically. The main operation, preventing intracranial complications, is a radical operation of the ear. Wide opening of all cavities of the middle ear and removal of pathological contents with joining of these cavities into one cavity provided with an adequate drainage through the external acoustic meatus is thus ensured. The operation gives an approach to the sigmoid sinus, the posterior and the middle cranial fossa and makes it possible to remove the thrombus from the vein or to open the brain abscess.

Sparing operations on the ear are now performed on patients with chronic purulent middle otitis (attico-antrotomy, antrodrainage). These operations preserve the remaining hearing function and ensure adequate sanitation to effectively prevent possible complications.

Great advances in reconstructive surgery, operational technology and instrumentation (operating microscope) have been made in the past decades. This made it possible to carry out operations aimed at improving the hearing function of man. These operations are tympanoplasty (in chronic purulent middle otitis and its complications, such as adhesive otitis, tympanosclerosis, exudative otitis), stapedoplasty in cases with otosclerosis, and auriculomeatotympanoplasty in cases with congenital defects of the external and middle ear.

The care and observation of patients with exacerbated chronic purulent middle otitis require special attention on the part of medical workers. The nurse should attentively watch the condition of the patient during the day time and at night because clinical manifestations of the intracranial complications may develop suddenly within a few hours. For example, normally the body temperature is measured two times a day, but if an intracranial complication is suspected, the temperature should be taken at a 3-hour interval (as prescribed by the physician). The respiration and the



- 78 What are the main preventive measures against complications of chronic otitis?
- 79 How shall nurse assist in injuries of tympanic membrane?

### First Aid in Injuries of the Ear

Injuries of the ear are classified as isolated, when only the auricle or the external acoustic meatus, the tympanic membrane, or separate elements of the middle ear are injured, and combined when injuries of the hearing organ are associated with injuries of soft tissues of the face, head, and the neck fractures of the facial bones or the cranium

Injuries of the tympanic membrane occur rather frequently by penetration of foreign objects into the acoustic meatus and by blows on the ear (the tympanic membrane is ruptured by the air wave caused by a blow) Therapy is aimed to prevent penetration of infection into the acoustic meatus A turunda soaked with alcohol or antibiotic solution is inserted into the ear for the purpose, and all manipulations in the ear are performed by sterile tools (by a physician)

Isolated injuries of the organ of hearing require the following aid if the auricle is injured it should be treated thoroughly surgically at a hospital with observation of all aseptic and antiseptic requirements, only non-viable portions of tissues may be removed, sutures should be placed on the injured skin, aseptic bandaging shall be finally applied

If the auricle is completely or almost completely torn off and delivered to the hospital together with the victim, an attempt should be made to replant it by suturing The separated auricle (or part of it) should be washed in an isotonic solution of sodium chloride and antibiotic solution, and sutured accurately

If the skin of the external acoustic meatus and the tympanic membrane is injured, the external portions of the ear should be cleaned thoroughly of dirt and foreign bodies and the meatus should be stoppered with a sterile turunda Only a specialist may perform operations on the tympanic membrane and the middle ear (in a hospital)

Combined injuries of the organ of hearing with involvement of soft tissues and cranial bones may be attended with fractures of the cranial base which often result in the hearing loss and grave intracranial complications



Treatment of such patients should be determined by agreement between a traumatologist, neuropathologist, neurosurgeon, otorhinolaryngologist and a roentgenologist

*Answers to Review Questions*

- 56 The external, middle, and inner ear
- 57 The auricle and external acoustic meatus
- 58 Helix, lobule, external acoustic meatus, concha, anthelix, tragus, antitragus
- 59 Tympanic cavity, antrum, auditory tube, mastoid air cells
- 60 Malleus (hammer), incus (anvil) stapes
- 61 Pars tensa and pars flaccida, handle of the malleus and the malleolar prominence, umbo of the membrane, and the cone of light
- 62 Vestibule, cochlea, semicircular canals
- 63 In the vestibule and semicircular canals
- 64 In the cochlea, on the spiral plate The spiral (Corti's) organ
- 65 Osseous labyrinth is filled with perilymph and membranous labyrinth with endolymph
- 66 Direct and optic otoscopy
- 67 Siegle's speculum, otomicroscope
- 68 Whisper and normal speech, tuning forks, tonal and speech audiometry Play audiometry for children
- 69 Rotative, caloric, and stato-kinetic tests
- 70 Thorough cleaning of the external acoustic meatus from pathological material
- 71 Acute rhinitis and exacerbation of chronic rhinitis and sinusitis
- 72 No
- 73 Otorhinolaryngologist
- 74 Acute external otitis, furuncle of external acoustic meatus
- 75 Meningitis
- 76 Vasoconstrictive drops in the nose
- 77 Thrombosis of the sigmoid sinus, abscesses of the brain and cerebellum, meningitis
- 78 Sanating operation on the middle ear
- 79 Prevention of infection penetration into the acoustic meatus

# DISEASES OF THE EYE

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## ANATOMY AND PHYSIOLOGY OF THE ORGAN OF VISION

The eye is one of the most important organs of senses of man. It perceives about 80% of stimuli from the environment.

The information taken by the eye is processed by a complicated system known as visual analyzer, whose main part is found in the cerebral cortex of the central nervous system.

The eye is the most important peripheral organ of this system which perceives light stimuli. The internal coat of the eye, the retina, is intimately connected (by its aetiology) with the brain and is its peripheral part.

Paired optical fossae on the germinal lenticular plate of a human embryo appear at the end of the second week of gestation. They may be seen on the frontal surface of the neural ectoderm from which the central nervous system will later develop. Primary vesicles, located by sides of the encephalic vesicle, are formed by the end of the first month. The main elements of the eyeball are formed by the fourth month of gestation, and at later terms they undergo further differentiation.

*Growth of the eye.* The growth of the orbit is mainly completed at the age of 10 to 14 years. The lid slit of a neonate is two times narrower than of an adult, and it only attains its normal size at the age of 8-10. The eye of a child is markedly larger than of an adult (relatively to the size of the body). The eyeball of a neonate is located somewhat more anteriorly than in an adult which is explained by greater depth of the orbit in adults. The cornea of a neonate has a larger diameter but it normalizes by the age of two. The iris of the eye in a neonate is of lighter shades and is slightly blue. As the pigment is formed on the anterior surface of the iris, the eye acquires its normal (brown, blue etc.) colour.

Knowledge of age characteristics of the eye is necessary for correct estimation of changes occurring in the organ of vision. For example, when intraocular pressure increases in a neonate in connection with distensibility of a thin sclera, the eyeball increases in size, which does not occur in adults to such an appreciable extent.

## AUXILIARY AND PROTECTIVE APPARATUS

**The orbit.** The eyeball is located in a depression of the bony cranium and is thus reliably protected from possible injuries. The orbit resembles a tetrahedral pyramid with an open base and the apex directed inside the cranium (Fig 98). The walls of the orbit are formed by the bones of the cranium and have openings and slits to communicate the orbit with the adjacent cavities of the head.

Four walls are distinguished in the orbit: the superior, the inferior, the external and the internal wall. Their thickness is different. The external wall, formed by the zygomatic process, is the thickest; the internal bone, formed by the ethmoid and lacrimal bones, is the thinnest. This bone is the lateral bone of the ethmoidal labyrinth. The superior

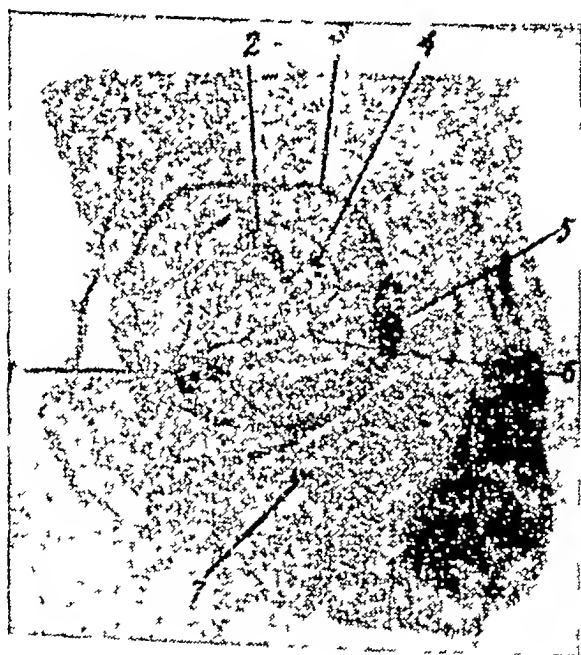


Fig 98 The orbit (frontal view)

1—inferior orbital fissure, 2—superior orbital fissure, 3—frontal bone, 4—optic nerve canal, 5—lacrimal bone, 6—ophthalmic process of the palatine bone, 7—maxilla

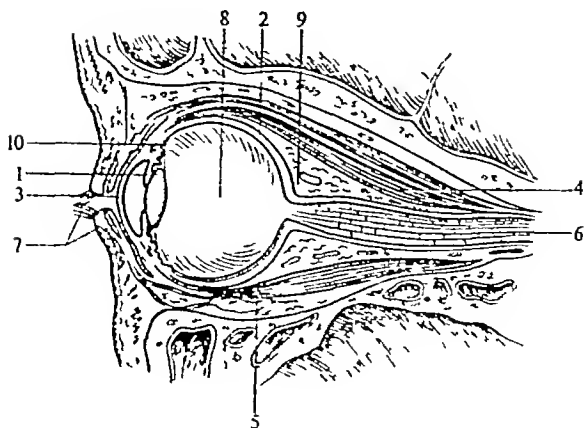


Fig 99 The orbit (vertical section)

1—lens, 2—sclera, 3—cornea 4—superior rectus muscle, 5—inferior rectus muscle, 6—optic nerve, 7—eyelids, 8—vitreous body, 9—fatty tissue, 10—ciliary body

wall of the orbit is composed of the frontal bone and the lesser wing of the sphenoid bone, and is the inferior wall of the frontal sinus. The inferior wall of the orbit, formed mainly by the maxilla, is at the same time the wall of the maxillary sinus. The optic canal is located at the apex of the orbit, the optic nerve and the ophthalmic artery pass through it. The nerves and the arteries also pass through the superior and inferior orbital fissures.

The superior orbital fissure communicates the orbit with the medium cranial fossa. The oculomotor, trochlear, and the abducent nerves, the ophthalmic branch of the trigeminal nerve, and the superior ophthalmic vein pass through this fissure. The zygomatic and the infraorbital nerves and the infraorbital artery pass into, and the inferior ophthalmic vein leaves the orbit through the inferior orbital fissure.

The orbit is lined with thin periosteum. The eyeball is about 20% of the orbit contents, the remaining space being occupied by fat tissue, external muscles of the eye, blood vessels, nerves, ligaments, and connective tissue (Fig 99). The eyeball is separated from the connective tissue by a thin fascia (fascia of Tenon) that forms a capsule through which the muscles are passed to the eyeball.

Anteriorly the orbit is closed by the tarso-orbital fascia.

(that passes from the orbital edge of the superior and inferior palpebral cartilages) and by the lids, which protect the eye from external effects and from drying

**The eyelids** These are two movable folds consisting of skin, muscles, cartilage and conjunctiva (Fig 100) The free edges of the upper and lower eyelids meet to form the lateral and medial palpebral commissurae The space formed by the arches of the medial palpebral commissurae forms a lacrimal lake with a fleshy lacrimal eminence at the bottom known as the caruncle The skin of the lower lid is continuous with the skin of the face without forming any marked border The upper boundary of the upper eyelid is the superciliary arch

Underlying the skin is the orbicular muscle of the eyelid that closes the lids It is innervated by the facial nerve When the muscle is paralyzed the eyelids are not closed and the eye slit remains open (lagophthalmos) The upper eyelid invests the levator muscle that lifts the upper eyelid It originates at the depth of the orbit from the opening of the optical nerve, passes along the superior wall of the orbit and attaches to the upper eyelid cartilage and the conjunctiva of the palpebral fold The tendon is interlaced with the skin and the orbicular muscle of the eyelid The levator muscle of the upper eyelid is innervated by the oculomotor and sympathetic nerves The muscle raises the upper eyelid to open the optic foramen The cartilage is a firm connective tissue investing the meibomian glands which open into the free margin of the eyelid, nearer the posterior edge The excretion of the glands prevents maceration of the eyelid margin and holds tears from rolling over onto the cheek Sebaceous glands are located by the anterior edge of the eyelid, where two or three rows of eyelashes grow

The side of the eyelid facing the eyeball is coated with mucosa, the conjunctiva that is continuous with the eyeball The line of reflection of the conjunctiva from the eyelid to the eyeball is called the conjunctival fornix When the eyelids are closed, the conjunctiva of the eyelids and of the eyeball form a narrow slit-shaped cavity, the conjunctival sac

The blood supply of the eyelids is derived from the branches of the ophthalmic and the maxillary arteries that form

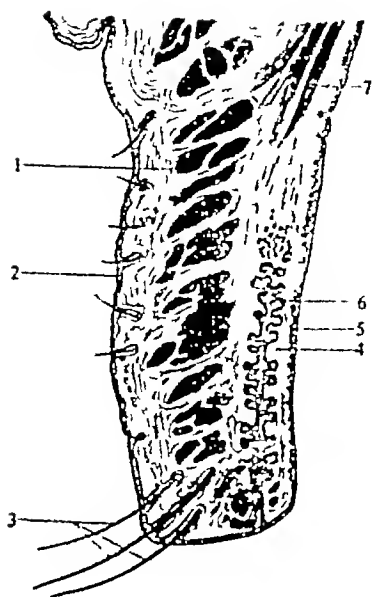


Fig 100 The upper eyelid (sagittal section)  
 1—orbicular muscle, 2—skin,  
 3—eyelashes, 4—cartilage,  
 5—conjunctiva, 6—meibomian  
 gland, 7—levator muscle of the  
 upper eyelid

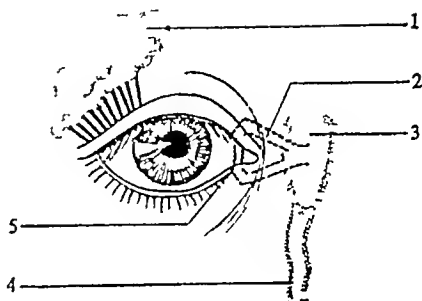


Fig 101 Lacrimal system  
 1—lacrimal gland, 2—lacrimal  
 duct, 3—lacrimal sac, 4—nasolacrimal  
 duct, 5—lacrimal  
 punctum

the superior and inferior arterial arches in the eyelids. Ample blood supply ensures prompt and effective healing of wounds in the eyelids. The veins pass along the arteries, but their number is greater and they open into the veins of the face and the orbit. This should be remembered because infection can be carried from the eyelids into the orbit and the cavernous sinus and cause complications.

The eyelids are innervated by the 1st and 2nd branches of the trigeminal nerve.

**Lacrimal apparatus** This consists of the secreting organ (the lacrimal gland, accessory lacrimal glands in the conjunctiva) and the lacrimal ducts comprising the lacrimal canaliculi, the lacrimal sac, and the nasolacrimal duct (Fig 101). The lacrimal gland is located in the recess of the anterosuperior wall of the orbit. The lacrimal ducts open into the

anterior portion of the superior conjunctival fornix. The ducts begin with the lacrimal puncta in the eyelids near the medial angle of the eye. The ducts first extend in the vertical direction to a distance of 1.5 mm and then become horizontal (7-9 mm) and enter the lacrimal sac. The sac is located in the lacrimal fossa of the lacrimal bone and is continuous with the nasolacrimal duct. The duct is 12-14 mm long and opens in the region beneath the inferior concha in the inferior nasal passage.

**Oculomotor apparatus** The eye movements are controlled by six external muscles, viz., the superior, inferior, lateral and medial rectus muscles and the superior and inferior oblique muscles. All muscles, except the inferior oblique muscle, originate from the common tendinous ring surrounding the optic foramen. The inferior oblique muscle originates from the orbital periosteum, at its posterointerior edge. The anterior ends of the muscles are attached to the sclera at various distances from the cornea.

The muscles are innervated as follows. The lateral rectus muscle is innervated by the abducent nerve originating from the nucleus located in the grey substance of the Sylvius aqueduct, near the nucleus of the oculomotor nerve, the superior oblique muscle is innervated by the trochlear nerve whose nucleus is located at the bottom of the 4th ventricle. All other eye muscles are innervated by the oculomotor nerve.

### THE EYEBALL

The eyeball is almost a regular sphere (Fig 102). Its basic elements are as follows: (1) the external coat, a fibrous membrane consisting of the cornea and the sclera, (2) the middle coat, composed of blood vessels, it comprises three layers: the iris, the ciliary body and the chorioidea (the choroid), (3) the internal coat, or the retina, (4) the aqueous humour of the anterior and the posterior chambers, the lens, and the vitreous body.

The lens, the vitreous body and the aqueous humour of the eye together with the cornea form a light-refracting (dioptric) apparatus of the eye.

Consider now in more detail the anatomic structure and the function of separate elements composing the eyeball

The cornea is the outer, most prominent part of the eye. It is clear and freely passes the light into the eye. Its shape can be likened to a convex lens whose function is focusing a light beam on the retina. The cornea is amply innervated and even a slight touch causes pain, reflexory winking, and lacrimation.

The cornea is continuous with the sclera. It forms the posterior part of the cornea and invests five-sixths of the external coat of the eye. Sclera is a firm white fibrous tissue. Posteriorly the sclera thins into a lamina cribrosa provided with small perforations through which the fibres of the optic nerve enter.

The edge of the cornea where it joins the sclera is called the limbus of the cornea. It is a semi-transparent belt embracing the cornea.

The iris is easily seen through the cornea. Its colour differs depending on the pigment contained in it. The centre of the iris has an opening known as the pupil, whose aperture varies depending on illumination. In the light it narrows and in the dark widens. This is done by two muscles, one of which contracts and the other dilates the pupil.

The iris converts into a ciliary body at the level of the limbus. The inner surface of the ciliary body has ciliary processes extending into the cavity of the eye. Their function is to produce the fluids of the eye. Anteriorly to the ciliary body is located the ciliary muscle which is attached to the sclera at the level of the limbus. The muscle is important for the accommodative faculty of the eye. The coat investing the blood vessels, the choroid (chorioides), is located posteriorly to the ciliary body. The ciliary body and

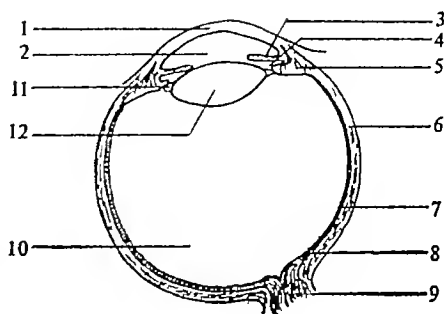


Fig 102 The eyeball

1—cornea, 2—anterior chamber, 3—iris, 4—posterior chamber, 5—ciliary body, 6—sclera, 7—choroid, 8—retina, 9—optic nerve, 10—vitreous body, 11—Zinn's ligament, 12—lens



the choroid lie by side of the sclera to form a narrow capillary slit, the suprachoroid space, and join the sclera only at the point of entrance of the optic nerve at the limbus, where the ciliary muscle is attached

If the external coat of the eye is removed, it looks like a dark berry of grapes (Hence the name uveal tract, from Latin *uva* grape)

The main function of the choroid, supplying much blood to the eye pigment, is to replenish the optical substance which is destroyed in the process of vision

The internal membrane of the eye, the retina, is the most important with respect to the optical function. Its two-thirds are composed of differentiated nerve elements responsible for the optic function. At the point where the ciliary body joins with the choroid, the optical portion ends in ora serrata where the retina is tightly joined with the underlying tissues. The other point of attachment is at the exit of the optic nerve. Along the remaining portion of the retina it is held in place mainly by the pressure of the vitreous body and the intimate connection between the layer of rods and cones and the protoplasmic processes of the pigment epithelium. An important point is the site of exit of the optic nerve, i.e. the optic disc and the yellow spot, which is found about 3-4 mm toward the temporal bone and slightly superiorly to the optic disc.

The optic nerve is formed by the axons of the ganglionic cells through which the nerve stimuli are transmitted from the retina. The optic nerves form a chiasm (an  $\lambda$ -shaped crossing) in the cranium. The nerve fibres of both eyes cross here partly and emerge from the chiasm as two separate nerve trunks (optic tracts) which end in the primary optic centres from which the optic nerve fibres lead to the cortical optic centres in the occipital lobe of the brain (Plate 9).

The liquid contents of the eye is the aqueous humour of the anterior and posterior chambers, the lens, and the vitreous body. The anterior chamber is formed anteriorly by the cornea, posteriorly by the iris, and in the region of the pupil by the lens. The maximum depth of the anterior chamber is 3.5 mm (at the pupil centre).

The site of junction between the cornea and the sclera, and also between the iris and the ciliary body is very impor-

tant for the outflow of the fluid from the anterior chamber. The zone comprises the trabecular system and the Schlemm canal.

The posterior chamber is limited anteriorly by the iris, posteriorly by the vitreous body, laterally by the ciliary body and medially by the equator and the pre-equatorial zone of the lens.

The lens is actually a double convex transparent body found posteriorly to the iris. It is an important refracting organ in the optic system of the eye. Zinn's tendons (ciliary zonule) originate here. They are attached to the entire inner surface of the ciliary body. Some of them are interlaced with the anterior surface of the vitreous body. The iris and the lens divide the eye into two portions, the anterior and posterior.

The posterior portion of the eye is filled with the vitreous body which is a transparent jelly-like substance.

#### VASCULARIZATION AND INNERVATION OF THE EYE

Blood is supplied to the eyeball from the ophthalmic artery, which is the branch of the internal carotid artery. Many branches ramify from the ophthalmic artery: the central artery of the retina, the lacrimal artery, long and short posterior ciliary arteries, etc.

The blood is drained through veins that run along the arteries and through the vorticosae veins that pass through the sclera beyond the equator and carry the blood from the eye to the orbit. The superior ophthalmic vein is the main collector of the venous blood outflowing from the orbit and the eye. The vein leaves the orbit through the superior ophthalmic fissure and empties into the cavernous sinus.

The anterior ciliary veins empty (partly) into the deep facial vein. The orbital veins anastomose with the veins of the face. The largest anastomose is the angular vein running near the medial angle of the eyelids and connecting the anterior facial and the superior ophthalmic vein.

The eye is innervated by the 1st branch of the trigeminal nerve (ophthalmic nerve and the ramifying branches). Sympathetic fibres originate at the ciliospinal ganglion located



## Chapter 1

# Visual Function and Methods of Its Examination

A nurse of an ophthalmological department (in a polyclinic or a hospital) often takes part in the examination of the main visual functions of the eye (determining the visual acuity, the field of vision, etc.) The nurse should be well acquainted with the methods used in these examinations because diagnosis of the disease and the therapeutic tactics often depend on correct and accurate examination of the eye (for example, narrowing of the visual field in a glaucoma patient may indicate ineffective conservative treatment and the necessity of a surgical operation)

### VISUAL ACUITY AND ITS DETERMINATION

Central vision characterizing the ability of the eye to discriminate the shape of an object and its details, etc., is the most important faculty of the human eye. This is ensured by a small portion on the macula known as the central fovea of the retina. When we speak about acuity of vision we mean acuteness of the central vision.

Acuity of vision is characterized by a minimal angle within which the eye can discriminate two points. In most persons the threshold angle of vision is 1 minute. Charts used for testing visual acuity employ this principle. The charts comprise twelve lines of printed letters or other characters in gradually decreasing sizes. Details of the biggest letters can be seen at an angle of 1' from a distance of 50 m, while of the smallest, from a distance of 2.5 m.

Visual acuity is determined by the formula

$$V = d/D$$

where  $V$  is visual acuity,  $d$  is the distance from the examinee to the chart (normally 5 metres), and  $D$  is the distance from which details of letters in a given line can be distinguished at an angle of  $1'$  (the distance is indicated at the beginning of each new line of the testing chart). If the examinee can read only the first line (the biggest letters) his visual acuity is 0.1. A person with normal vision distinguishes details of the letters from a distance of 50 metres. Normal visual acuity in most people is 1.0, i.e. letters in the tenth line can be distinguished freely from a distance of 5 metres.

In testing visual acuity, the procedure should be standardized and all instructions strictly followed.

When testing acuity of vision in a person, the nurse should see to it that the examinee should not move his head forward, or narrow the eye slit, or press the eye, etc. When a short-sighted person narrows the eye slit (screws the eye), visual acuity is improved by decreasing light scattering circles. When the eye is pressed upon, the blood supply is impaired by reflection in the other eye. Visual acuity of each eye is normally tested separately. In order to separate the eyes (to rule out binocular vision) a white opaque plate should be held in front of the other eye (without touching it). This method is devoid of the disadvantages when the eye is closed with the palm of the hand. It is recommended that characters in the tenth line should first be observed by the patient with gradual transition to larger lines.

Two letters may be identified wrongly in the lines corresponding to visual acuity of 0.7, 0.8, 0.9, and 1.0, but a special record should be made in the case history of the patient.

If a patient fails to identify more than two letters in a given line, his visual acuity should be tested by reading next, larger, line.

A patient may only misname one letter in the lines corresponding to visual acuity of 0.6, 0.5, 0.4, and 0.3. All letters should be identified correctly in the first two lines.

If a patient fails to identify the letters in the first line (or identifies them incorrectly), he should be directed to approach the testing chart to a distance at which he may clearly see the first line. Visual acuity shall then be assessed by the formula given above. If a patient can read the first line, for example, from a distance of 3.5 metres, his visual

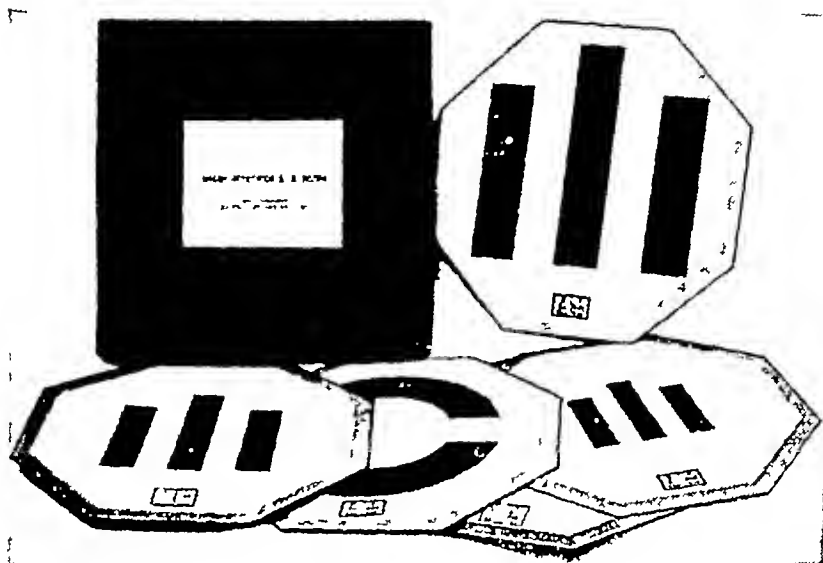


Fig. 103. Set of optotypes

acuity is 0.07. For determining visual acuity lower than 0.1, it is recommended to make marks at 0.5 m intervals on the floor (or the wall) of the room. It should also be remembered that two letters in the first line can easily be remembered by the patient and it will interfere with correct estimation of his visual acuity. In such cases it is convenient to use test types (optotypes) shown in Fig. 103, whose size is so calculated that the width of the lines and of the spaces between them correspond to visual acuity of 0.09, 0.08, 0.07, 0.06, 0.05 and 0.04 as viewed from a distance of 5 metres. An optotype is placed in the apparatus used for illumination of the test charts. If visual acuity of a patient is below 0.04, he should be moved to a shorter distance (2.5 m and less).

Visual acuity below 0.1 may also be tested by showing the patient the fingers of the examiner's hand from a distance less than 5 metres (with the admission that the width of the fingers and of the characters in the first line are approximately the same). The test procedure is as follows. The patient is seated in a chair and observes the space in front of him with the tested eye (the other eye being screened). The nurse

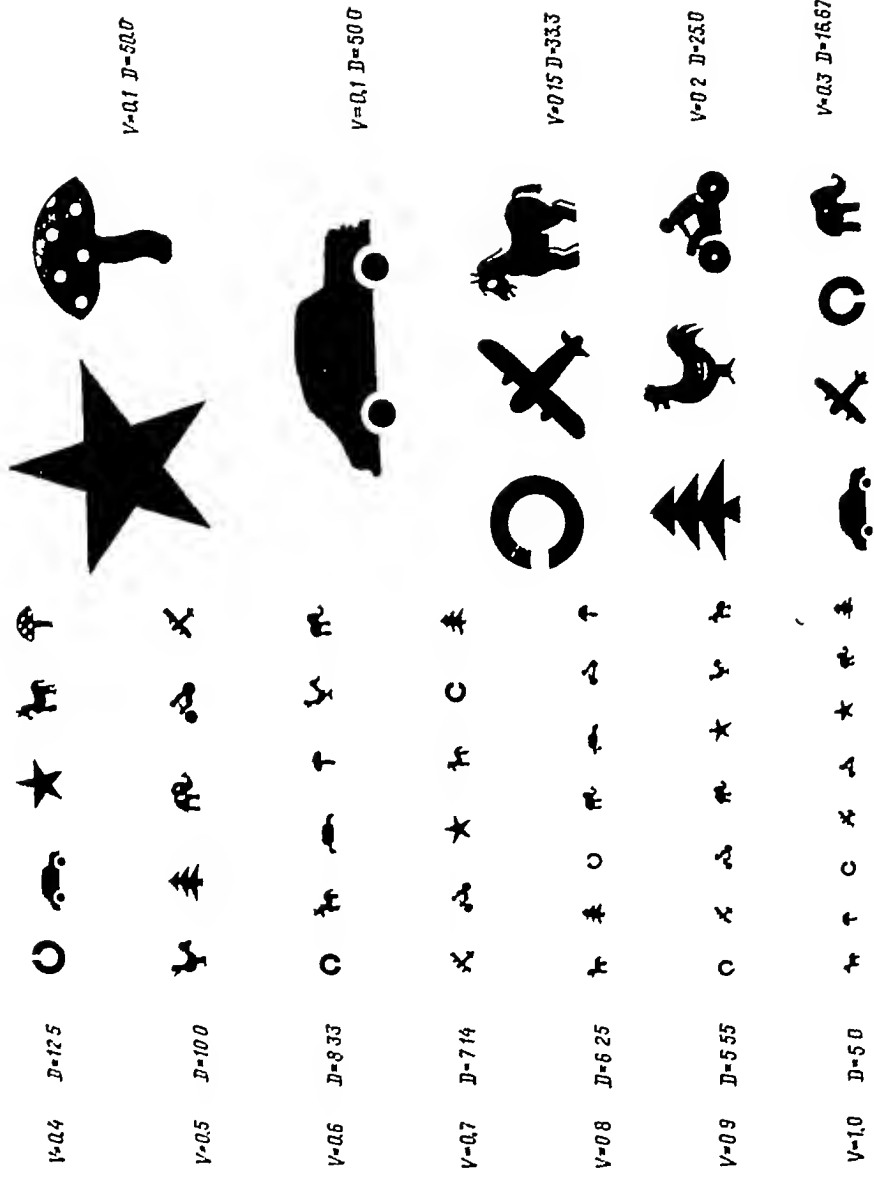


Fig 104 Chart for testing visual acuity in children

shows her fingers (1-3) against a black background and approaches the patient until he is able to count the fingers. Depending on the distance  $d$  visual acuity may now be determined using the above formula. A person with normal vision can count fingers at a distance of 50 metres. If a patient can count fingers, for example, from a distance of 2 metres his visual acuity is  $0.04 \left( \frac{2}{50} \right)$ .

Difficulties arise in testing visual acuity in infants. A chart of pictures (Fig 104) is then used. Before a baby is tested, it is brought close to the chart and asked what pictures it sees.

The testing begins with the first line (the largest pictures), the infant being asked to identify only one object (children are easily tired). If a baby does not identify an object, all other objects in this line should be tried and then in the line above it, etc., until most pictures in a given line will be identified correctly. This line should be used for assessment of the child's visual acuity.

Instruments for testing visual acuity are being constantly improved. Apparatus for projecting types and test signs are now widely used. An apparatus with a remote control, named 'Vizomer', has been developed in the Soviet Union.

#### PERIPHERAL VISION AND FIELD OF VISION

In addition to the central vision, man has the faculty of peripheral vision, which is very important for orientation and free movement in space. When a patient has no peripheral vision he is disabled and behaves like a blind although his central vision may remain normal. Peripheral vision is less clear and its acuity is many times worse than central vision, which is explained by the fact that the number of cone cells (responsible for central visual acuity) decreases in the direction from the central fovea of the retina toward the periphery, while the number of rod cells increases. Testing peripheral vision becomes important in glaucoma, diseases of the optic nerve, retina, etc.

Peripheral vision is characterized by the field within which a fixed eye can see. In other words by field of vision.



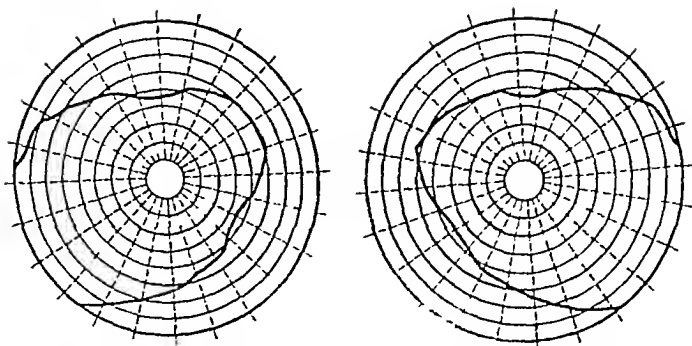


Fig 105 Normal boundaries of the field of vision

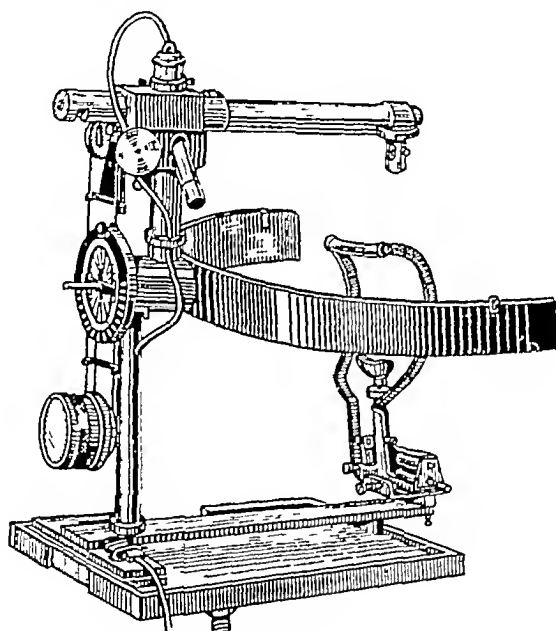


Fig 106 Projection perimeter

is understood that portion of space which can be perceived by a fixed eye. Field of vision of each eye has its boundaries

Normal field of vision is characterized by an angle of  $90^\circ$  laterally,  $55^\circ$  medially,  $50-55^\circ$  superiorly and  $65-70^\circ$  inferiorly to the nodal point (Fig 105)

For accurate determination of the visual field, its boundaries are projected on a spherical surface. This principle is employed in determining the extent of visual field with an apparatus known as a perimeter (Fig 106)

The patient rests with his chin on the base plate of the apparatus in the centre of the perimeter arch, the patient's eye being positioned against the fixation point. The other eye is screened by a bandage. A nurse should see to it that the tested eye should be stationary directed at the fixation point. An object is now moved by the arch from its periphery toward the fixation point and the patient is asked to inform the nurse when he first sees the object (or when he stops seeing it as it moves toward the fixation point). Objects sizing from 1 to 5 mm are normally used in the test. The eye should be tested in at least six meridians. The degree of the arch at which the patient first sees the object is marked on the chart (fixed in the frame behind the arch). Determination of the field of vision separately for red, blue, and green light is important in some diseases of the eye. The procedure is the same as with a white object. According to V. P. Odintsov normal field of vision is characterized by the following data

Colour	Boundary (in degrees)			
	superior	lateral	inferior	medial
Blue	39	76	50	43
Red	35	70	46	37
Green	31	57	37	34

At the present time there are many new instruments for determining the extent of the peripheral vision.

Changes in the field of vision may be manifested not only by narrowing of its boundaries but also by defective vision, or blindness in part of the visual field (hemianopsia) in both eyes, or by appearance of limited defects known as scotoma. Scotomas may be detected by campimetry. The patient is placed at a distance of 1 metre from a black board sizing  $2 \times 2$  m, and asked to fix the eye on a white spot in the centre of the board. Now a white square ( $3 \times 3$  mm or  $5 \times 5$  mm) is moved from the periphery toward the centre and the moment of disappearance and appearance of the

object is marked. It should be remembered that defects are present in any field of vision of a normal eye (corresponding to the optic disc). This defective spot, known as the blind spot, is located about  $15^\circ$  from the fixation point toward the temple. Its size is about 6 arc degrees in the horizontal direction. The blind spot increases in size significantly in glaucoma, congestive optic disk and in some other diseases, which is important for their diagnosis.

### PERCEPTION OF COLOUR

Colour perception, or the power of the eye to discriminate colours, is very important, especially for painters, drivers, etc. Perception of colour is explained by the activity of cone cells which are mainly located in the central fovea of the retinal yellow macula. The human eye can discriminate very many shades of colour that can be obtained by mixing in various proportions red, green and violet. The conjecture that all possible colours may be obtained by mixing the main three colours was spoken out by the Russian scientist M. V. Lomonosov. His works in this field were later confirmed by Yung and other scientists. According to the theory of colour perception, the retina has three colour-perceiving components. Each component is specific toward its main (primary) colour, but it can also be excited by the other two colours, although to a lesser degree. If one of the colour components is defective, the patient's colour perception becomes impaired.

A person in whom all three components function normally is called a trichromat. Deviations from normal colour vision are classified as deuteranomalopia (green blindness), protanomalopia (red blindness), and tritanopia (blue blindness).

Various polychromatic tables are used for testing colour vision. If the patient is tested in daylight, he is seated with his back toward the window. A source of artificial light would be placed behind and to the left of the patient so that the table might be adequately illuminated. The illumination should be not lower than 200 lx. The tables should be shown to the patient from a distance of 0.5-1 metre, strictly in the vertical position, at the level of the patient's eye. The

time of exposure, 5 seconds The patient's answers are recorded in a chart The results of the test with each table are evaluated separately

### LIGHT PERCEPTION

The ability of man to perceive light and discriminate the degrees of intensity of the luminous flux is an important component of the visual function It is tightly connected with vision in dusk and dark When a person is placed in the dark, his eye is first unable to discriminate objects, but as the eye becomes adapted, his vision is improved The power of dark adaptation is very important for drivers, fliers, and other professions

The main role in light perception belongs to rod cells of the retina where special light-sensitive substance is concentrated In the dark this substance is destroyed at a slower rate than in the light and this increases light sensitivity of the eye Dark adaptation is impaired in some diseases Persons with hemeralopia (day blindness) or nyctalopia (night blindness) have defective orientation in obscure light

Special apparatus, adaptometer, is used for the study of light perception and dark adaptation The operating principle of the apparatus is based on the known Purkinje's phenomenon that the maximum of brightness of the colour spectrum shifts from the red to the blue region if the intensity of illumination is decreased The simplest adaptometer is a dark chamber inside which four colour squares are installed (green, blue, yellow, and red) Illumination of the test squares is gradually increased As the eye is adapted to the dark, the patient first distinguishes the yellow and the blue square If colour vision and dark adaptation are normal, the time of adaptation varies between 15 and 60 seconds The light perception of a person is thus estimated by the time required for the examinee to distinguish the test squares

### BINOCULAR VISION

By binocular vision is understood a coordinated function of both eyes that is ensured by simultaneous orientation of the optical axes toward the object of fixation, by fusion of

the optic images of each eye into a single image, and location of this image in space

The field of vision is widened due to binocular vision to  $180^\circ$  in the horizontal plane, and a more distinct perception of the object is obtained due to summation of the stimuli. And finally, binocular vision ensures a three-dimensional or stereoscopic vision that ensures perception of the depth of the observed objects and their position in space. Binocular vision is especially important for drivers, fliers and other occupations.

Binocular vision is tested by a special apparatus (Belostotsky-Fridman) in which visual fields of the eyes are separated by colour filters. Two green openings (illuminated from behind) are arranged one above the other, with an opening of white colour in between them. The fourth opening (red) is located by side of the white opening. The patient puts on spectacles with different (red and green) glasses. As the colour openings are regarded through the red-green spectacles the persons who lack binocular vision will only observe red or green opening, while persons with normal binocular vision will observe both colours simultaneously.

### *Review Questions*

5 What is the threshold angle of the visual field? (1)  $5'$ , (2)  $1'$ , (3)  $10'$ ?

6 A person with normal vision will read the letters of the first line from a distance of (1) 10 metres, (2) 5 metres, (3) 50 metres. Choose the correct answer.

7 A medical nurse determined the extent of the patient's field of vision in four meridians. Did she strictly follow the requirements of the test procedure?

8 What elements of the retina are the main in perception of light (1) rod cells or (2) cone cells?

## Chapter 2

### Eye Refraction and Correcting Glasses

The eye has an optic system in which the main refracting elements are the cornea and the crystalline humour which act like a lens. As light passes these media, which are denser than air, the beam deviates from its rectilinear direction and is focused at a certain distance from these media on the optic axis of the eye. The cornea and the lens are convex. The physical science treats that a convex lens may be regarded as if consisting of two prisms connected at their bases. Each prism will refract the incident beam and deviate it toward the base, that is toward the optic axis of the lens, where the two beams will be focused.

The refractive power of a lens is measured in diopters. One diopter (1 D) is the power of a lens with a focal distance of one metre. The refractive power is inversely proportional to the focal distance.

Physical and clinical refractions are distinguished. The former is the refractive power of an eye expressed in diopters. This varies with different people. The study of the human eye has made it possible to derive the refractive power of an averaged eye which is 58.64 D.

It is useful to remember that the dioptric system of the eye is not permanent. It changes with the distance at which an object is regarded. When a person regards a near object refraction increases and the eye is adapted (accommodated) to new conditions of vision. Hence a dynamic refraction. By static refraction is understood the refraction when the eye observes far-off objects and is at rest.

Accommodation is the power of the eye to adjust the refractive power of its optic system to ensure clear vision at various distances. Accommodation of the eye depends on the ability of the lens to change its curvature. As the eye regards objects from various distances, nerve impulses arise in the eye which relax the suspensory ligaments of the lens and contract the ciliary muscle. The lens is elastic and there-

fore becomes more convex to increase its refractive power. If a book is brought gradually closer to the eye during reading (the other eye being closed) maximum strain in the accommodation apparatus will occur at a certain distance, and if the book is further moved toward the eye, reading will be impossible. The shortest distance from which small characters can be distinguished with the maximum accommodation of the eye is the nearest point of clear vision. The remotest point at which an object is clearly seen when the accommodation system of the eye is at rest is known as the far point. Beams of light reflected from this point are refracted by the optic system of the eye and focused on the retina.

Clinical refraction is the optical setting of the eye to the remotest point of clear vision with the eye at rest (static condition). This is characterized by the position of the main focus with respect to the retina (not by the focal length).

Three versions of clinical refraction are distinguished.

(1) Emmetropia. The remotest point of clear vision (far point) is at an infinitely great distance from the eye and the main focus is located on the retina. A person with emmetropia sees far and near objects equally well. This indicates adequate correlation between the refractive system of the eye and the axial length of the eyeball.

The two versions of refraction which follow below are characterized by ametropia, i. e. the absence of this correlation.

(2) Myopia (nearsightedness) is excess refraction, when the far point is at a rather short distance from the eye. This distance, for example in myopia described by 40 D, is 25 cm. Parallel rays are brought to a focus in front of the retina and the image is not clear. A person with myopia experiences difficulty in regarding remote objects or does not see them at all.

(3) Hyperopia (hypermetropia, or farsightedness) is characterized by inadequate refraction, as a result of which rays of light entering the eye parallel to the optic axis are brought to a focus behind the retina. A person with hyperopia feels difficulty while regarding near objects. If accommodation is adequate, far objects may be regarded without difficulty.

Most neonates are hyperopes. Congenital myopia only occurs in defects of the eyeball. Hyperopia decreases with the growth of the body and the eye and converts either in emmetropia or myopia.

Knowledge of clinical refraction and how to measure it is necessary for proper selection of correcting spectacles.

There exist two methods by which refraction can be determined. By one of them, the patient is asked to characterize his vision, this is a subjective method. The objective method employs an apparatus known as a skiascope. The refractive error is determined by observation of the movement of the illuminated area on the retinal surface. Refraction may also be measured by an ophthalmoscope.

Special skiascopic rules (Fig. 107) should be used for

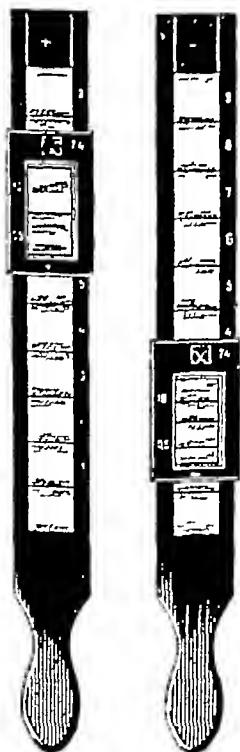


Fig. 107 Skiascopic rules

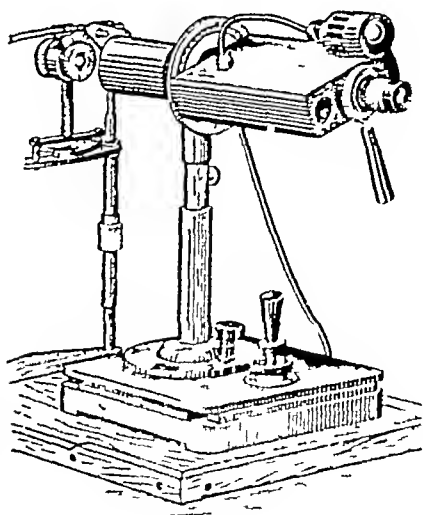


Fig. 108 Refractometer



skiametric determination of refraction error

Static refraction of the eye may be determined to high accuracy using a skiascope with medicamentous paralysis of the accommodation system

Refractometers (Fig 108) and ophthalmometers are also used for objective determination of the refraction error. These instruments ensure best accuracy of determination.

A nurse would normally determine refractive error of the eye by the subjective method. Acuity of vision should first be determined. The nurse takes a  $+0.5$  D lens from the set (Fig 109) and asks the patient to observe the testing chart through it. The following may occur: (1) vision worsens compared with an unaided vision (myopia or emmetropia may be suspected). A  $-0.5$  D lens is now tried: vision improves in myopia and remains the same or impaired in emmetropia, (2) vision remains unaffected or improved: hyperopia may be suspected. Stronger lenses are now tried (at  $0.25-0.5$  D gradient) until a new lens worsens vision. The

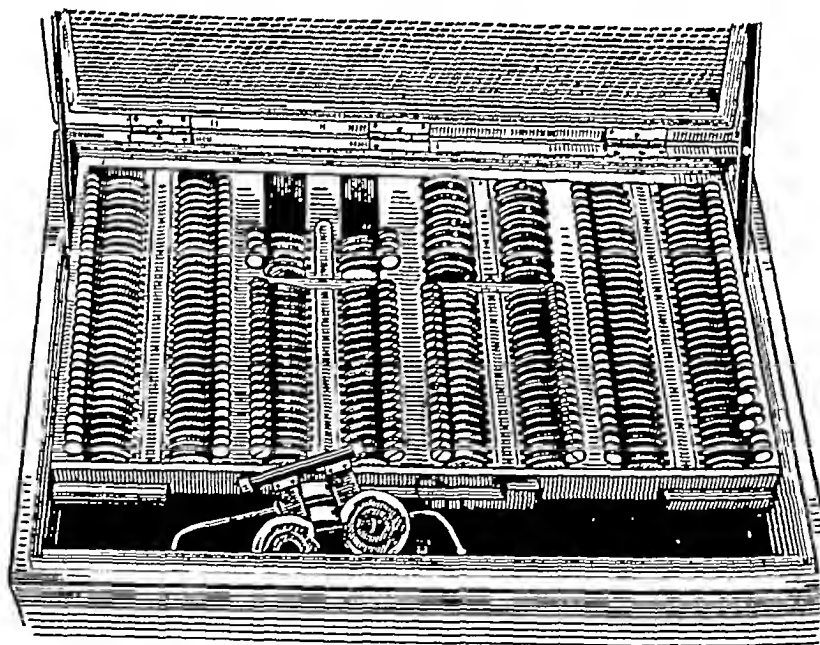


Fig 109 Set of correcting lenses

strongest lens that does not worsen vision determines hyperopia and should be prescribed to correct vision

If a patient with myopia is examined, scattering negative lenses should be tried (a 0.25 D gradient) until acuity of vision is best. The lens which ensures the best correction of vision determines the degree of myopia and should be prescribed for spectacles.

One eye may sometimes have different refraction in the vertical or horizontal meridians or in meridians arranged at an angle to the optical axis of the eye. There will be no clear illuminant point on the retina. The phenomenon is known as astigmatism, which means the absence of a sharp focus on the retina (from Greek *a* a negative prefix and *stigma* point).

Cylindrical glasses are used to correct astigmatism. The cylinders alter the refractive power of the eye mediums in one meridian only. It is sometimes difficult to choose a proper cylinder and special skill and instruments are required.

A subjective method of determining astigmatism may also be used. A special graduated frame holding a screen with a slit is installed in front of the tested eye and the screen is rotated until a position is found when the patient's visual acuity is best. The position is marked using the scale of the frame (graduated in degrees) and refraction in the given meridian is determined using spherical glasses. The slit is then turned through 90° and refraction is determined in the perpendicular plane.

To correct astigmatism, it is necessary to rule out the difference in refraction of various meridians of the eye. To that end, cylindrical glass is so positioned that its axis coincides with the direction of that meridian whose refraction will be left unchanged.

For example, we have determined that refraction of the eye in the vertical meridian is myopic and equals 2.0 D (M 2.0 D) and in the horizontal plane M 1.0 D. Install a cylindrical glass 1.0 D in position when its axis coincides with the horizontal meridian. Thus corrected eye will have myopia of 1.0 D, which may be corrected by a simple diffusing lens 1.0 D.

Below given are examples of prescriptions for correction of ametropia.

- 1 Correction of 1.5 D hyperopia  
Rp O U—Sph convex +1.5 D  
D p p 60 mm  
D S Spectacles for farsightedness
- 2 Correction of 2.0 D myopia  
Rp O U Sph concave 2.0 D  
D p p 62 mm  
D S Spectacles for nearsightedness

## 3 Correction of astigmatism

Rp O U Cyl concave  $-1.0$  D, ax  $180^\circ$ Sph concave  $-1.0$  D

D p p 60 mm

D S Spectacles for nearsightedness

The interpupillary distance is measured from the lateral margin of the cornea of one eye to the medial margin of the other using a rule (Fig 110) or a pupillometer

Presbyopia (old age hyperopia) The elasticity of the crystalline lens diminishes with advancing years and this weakens the accommodation power of the eye. A person with presbyopia feels fatigue and difficulties in reading and performing precision operations at a close distance.

The process starts at the age of 40 and by 60 the accommodation of the eye is practically lost. Collecting spherical lenses are used to compensate for the lost accommodation power.

Presbyopic spectacles are prescribed after determining the refraction of each eye separately and after the appropriate correction of imperfect refraction (ametropia). Lenses are added in accordance with the age of a presbyope:  $1.0$  D for persons aging 40,  $1.5$  D for the age of 45, and so on, adding  $0.5$  D for each next five years.

*Review Questions*

9 Imperfect eye refraction is excess in (1) farsightedness, (2) nearsightedness. Choose the correct answer.

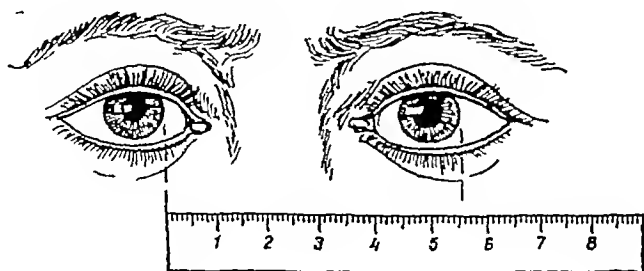


Fig 110 Measuring the interpupillary distance

10 A patient's vision worsens if a  $+0.5$  D lens is placed in front of the eye. What kind of refraction may be suspected? (1) emmetropia or hyperopia? (2) emmetropia or myopia?

## Chapter 3

### Ophthalmological Nurse

#### OPHTHALMOLOGICAL TOOLS AND EQUIPMENT

The room for ophthalmological examinations should meet the following requirements it must be convenient to give medical assistance to ophthalmological patients, all tools and instruments should be easily accessible, the furniture should be laid out in a reasonable manner, and the room should be sufficiently illuminated Two rooms would be normally required for ophthalmological examinations (one of them being dark) The main room should be at least 6 metres long, the width being not less than 3.5 m The dark room should measure at least  $1.5 \times 3.5$  m

Adequate illumination is necessary for accuracy of examinations and normal working capacity of the medical personnel The main criterion for assessment of illumination is the

*Table 1*

An approximate list of tools, instruments,  
and other equipment for ophthalmological examinations

Name	Name
Testing chart	Lifting table with a perimeter
Testing chart for children	Wash-stand
Maddox scale	Ophthalmoscopy and skiametry
Physician desk	table
Table for medicines	Lifting table with a slit lamp
Table for correcting lenses	Screw chair
Nurse's table	Lifting table with a projection
Tool cabinet	perimeter
Tonometry table	Campimeter
Couch	Lifting table with a refractometer
Chair	

coefficient of natural illumination (daylight factor) and the luminosity factor. The daylight factor is the ratio of illumination at a given area inside a room to the uniform horizontal luminosity in open air. This coefficient should be not less than 1.25%. In order to improve illumination in the room, its walls should be painted in light grey (reflection not less than 10%). The paint should be dull (to prevent lustre). Dark grey paint should be used for the dark room.

The ratio of the window area to that of the floor should be 1:3. Luminescent lamps are recommended for artificial illumination. Intensity of illumination at a height of 80 cm from the floor should be not less than 200 lx (100 lx for incandescent lamps). (One lux is the level of illuminance occurring when a luminous flux of one lumen falls on each square metre of the surface. A lumen is the flux radiating from one candela source through a solid angle of a steradian. A steradian is a dark angle of a cone whose vertex lies at the centre of a sphere with a radius of one metre, while the base of the cone forms an area of one square metre on the surface of the sphere.) Table 1 gives an approximate list of tools, instruments, and other equipment necessary for ophthalmological examinations.

### Duties of an Ophthalmological Nurse

A nurse performs an important role in ophthalmological examinations and treatment of patients. She determines acuity of vision in patients, chooses the lenses for simple correcting spectacles, prescribes the medicines and spectacles, measures intraocular pressure (tonometry), and determines the extent of the field of vision (guided by the ophthalmologist). Whenever a necessity may arise, the nurse should be able to examine (unassisted) the anterior portions of the eye and its appendages, to instill drops, apply ointments and bandages, to render urgent aid in acute diseases or injuries, and to remove foreign bodies from the conjunctival surface.

Before reception is begun, the nurse prepares the following solutions that may be required by the ophthalmologist: mydriatics (solutions dilating the pupil), viz., 1% atropine sulphate, 0.25% scopolamine hydrobromide, 1% homatropine

pine hydrobromide, 1% platyphylline hydrotartrate, 3% ephedrine hydrochloride and 1% benactyzine solution,

miotics (solutions contracting the pupil), viz, 1% pilocarpine hydrochloride, 0.01%, 0.013% and 0.02% phosphacol solution, etc,

anaesthetics, viz, 0.5-1% tetracaine hydrochloride solution,

anti-infectious preparations, viz, 20-30% sulphacetamide, 10% sulphamethoxypyridazine solution,

1% fluorescein solution

All bottles should be properly labelled

Mydriatics should be kept apart from the other solutions, and special care should be taken to preclude confusion of pipettes. Instillation of mydriatics by mistake may impair the patient's working capacity or exacerbate the disease, in some cases it may provoke an acute attack of glaucoma.

The nurse should sterilize the tools (forceps, probes, glass rods, syringes, needles, and eyelid lifters). Containers with sterile materials, such as wet tampons, wicks, etc should be kept on a dressing table ready for use.

*Preparing cotton wool balls* Dry cotton wool balls are prepared as follows: a piece of loose cotton wool is rolled circularly between the palms, thus prepared ball should then be sterilized in an autoclave by commonly used technique.

- Wet balls are prepared by boiling dry cotton wool balls in a 2% boric acid (where they are kept before use)

### Ophthalmological Department of a Hospital and Its Equipment

An ophthalmological department has several wards, a dressing room, an examination room (with a dark room), an operation and a postoperative room, and auxiliary rooms.

Equipment of an ophthalmological department does not substantially differ from that of other departments, except that special wards are intended for patients with purulent diseases of the eye and postoperative patients.

A dressing room is intended for medical procedures that cannot be performed in the ward. Medicinal preparations are also kept in this room. The room should be spacious and

adequately illuminated. Its equipment comprises the following

#### Furniture

- cabinet with glass walls and shelves (to keep trays with medicinal preparations),
- table for containers with sterile materials for dressing and other manipulations,
- cabinet for medicinal preparations in common use,
- cabinet for spare medicinal preparations (store),
- firm couch,
- bench for intravenous infusion,
- glass cabinet (table) for tools,
- stools

#### Tools and instruments

- needles for removal of foreign objects from the cornea,
- ophthalmic mouth-tooth forceps,
- thumb ophthalmic forceps,
- epilating forceps,
- Desmarres' eyelid lifter,
- scalpel,
- ophthalmic scissors, curved and straight, with blunt and pointed ends,
- set of cone-shaped probes,
- needles with blunt ends for irrigation of lacrimal ducts,
- injection needles,
- syringes, 2, 10 and 20 g,
- ophthalmic spatulas,
- pipettes,
- glass flasks with ground-in pipettes or stoppers,
- glass rods,
- rubber bulb or undine,
- kidney-shaped enamel basin,
- sterilizers

A wash-stand should obligatory be present in the dressing room. An operating block includes a preoperative and operative rooms. Cabinets with tools, medicines, dressing materials, a couch, stretchers, and a litter for transportation of grave patients are in the preoperative room. A special room should be provided for preparation of sterile materials. Overalls, bed-sheets, masks (for medical personnel and patients) should be sterilized separately from materials in-

tended for carrying out operation (cotton wool and gauze pads, gauze tampons, cotton wool wicks, etc ) which should be sterilized in a special container

The operation room equipment includes an operating table, tables for tools, dressing materials and medicinal preparations, and other objects that might be required during operation

Artificial illumination is important for an operating room. A portable lamp giving no shade (diffused light), consisting of a stand, a reflector and a lampholder, is very convenient. It provides adequate illumination of the operating field irrespective of the place of its installation. Lamps may also be suspended from the ceiling

Figs 111 through 120 show commonly used ophthalmic tools

An electric or permanent magnet should be available in an operating room (Fig 121). Operating microscopes and other instruments are now widely used in ophthalmological practice

### Duties of a Hospital Nurse

A hospital nurse meets the patient and accompanies him to his ward (depending on the condition of the patient). She must acquaint him with the regulations of the hospital. She gives the patient the prescribed treatment and makes appropriate notes in the chart.

*Preparing the patient for operation* Correct pretreatment of the patient for operation is important for success of surgical intervention. The hospital nurse should see to it that the patient's blood and urine be tested before operation and the corresponding notes introduced into the case history. Of all other preoperative tests, the test for blood coagulability is the most important. The nurse should examine the patient's skin and if eruptions, furuncles, etc., are found the nurse should report to the physician, because these pathological changes may contraindicate the operation. The nurse should ensure the conditions that would not add excitement to the patient before the operation. Many patients are given sedatives and anaesthetics on the eve and on the day of the operation. Pipolphen would be usually given, 1 tablet be-



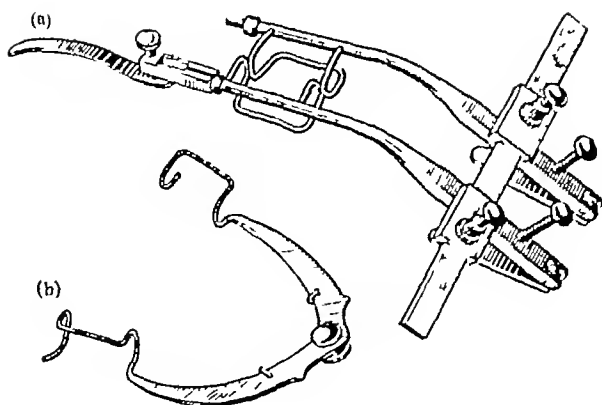


Fig 111 Blepharostats  
*a*—sliding, *b*—horseshoe-shaped

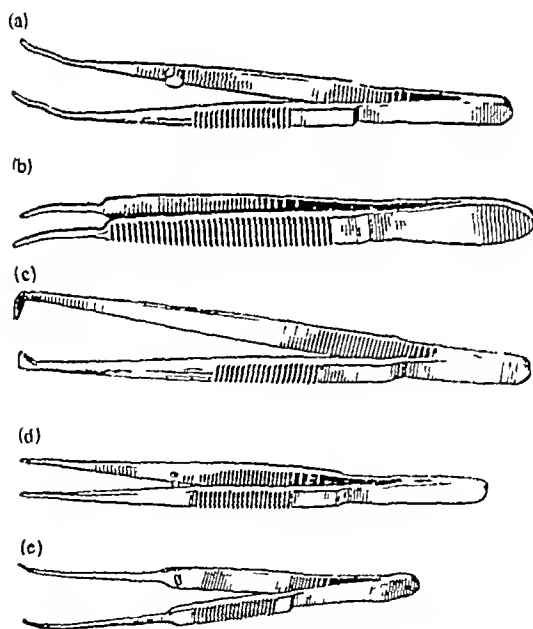


Fig 112 Forceps  
*a*—capsule forceps, *b*—thumb forceps, *c*—fixation forceps, *d*—pointed (microsurgical) forceps, *e*—mouse-tooth forceps

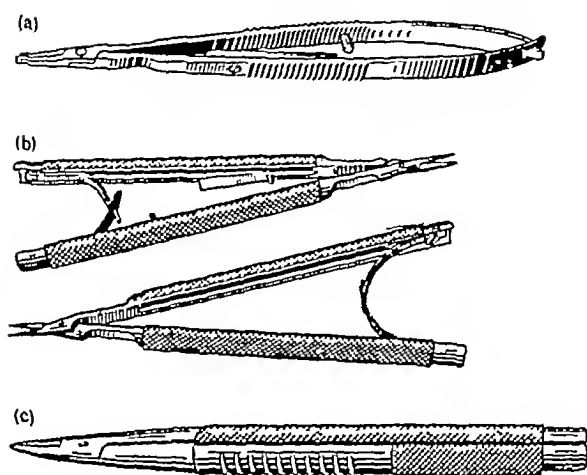


Fig 113 Holders

*a*—for atraumatic ophthalmic needles, *b*—microsurgical (Castroviejo),  
*c*—blade-holder

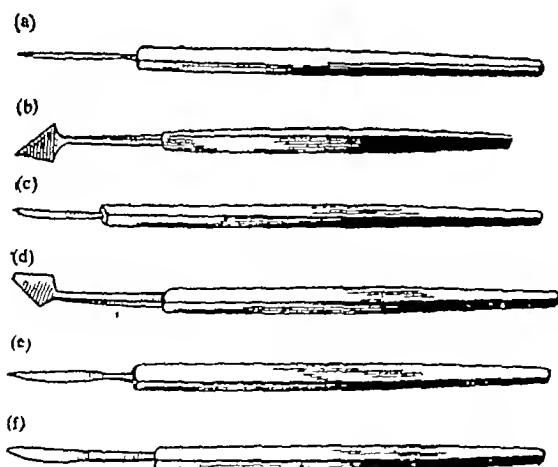


Fig 114 Knives

*a*—microsurgical (microtome), *b*—spear-shaped, *c*—sclerotome, *d*—  
 blunt-end knife, *e*—cataract knife, *f*—single-bladed knife

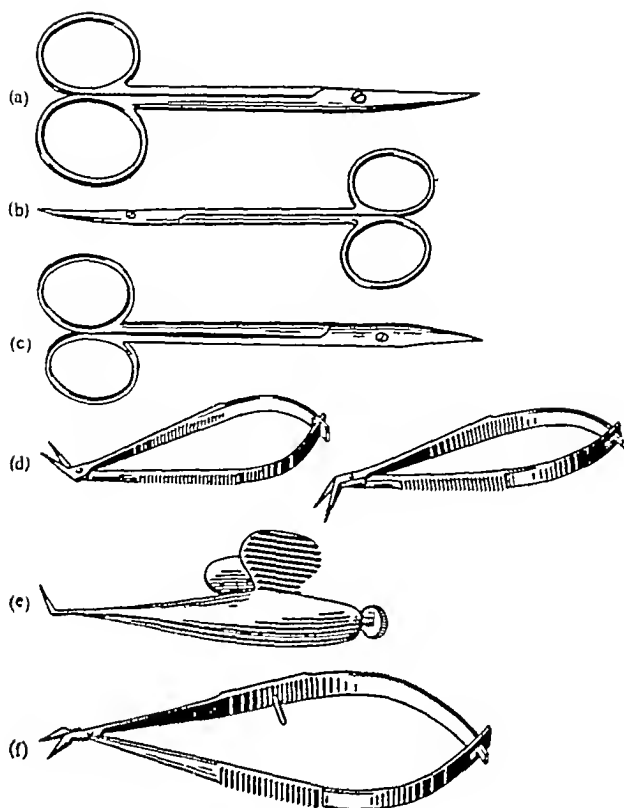


Fig 115 Scissors

*a*—for enucleation, *b*—vertically bent pointed, *c*—for removing sutures, *d*—de Wecker's cornea scissors (right and left), *e*—forceps-scissors, *f*—de Wecker's microsurgical scissors

fore night sleep and in the morning before the operation Promedol (subcutaneously) is a good anaesthetic and sedative preparation (1 ml of a 2% solution) A mixture containing 2 ml of a 2.5% aminazine and 2 ml of a 2% promedol is given intramuscularly an hour before the operation

A cleansing enema is given to the patient on the eve of the operation and the nurse should see to it that the patient's bowels are emptied

Hair of the patient requires special care A gauze napkin should be placed over the hair before the operation. The plaits should be unbraded, all hair pins removed If the eyeball will be opened during the operation the eyelashes

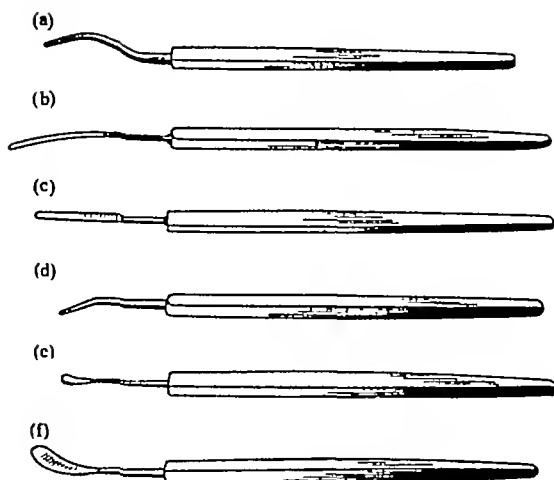


Fig 116 Spatulas

*a*—for separation of sclera, *b*—grooved, non-magnetic, *c*—flat, non-magnetic, *d*—microsurgical, *e*—scarificator No 1, *f*—scarificator No 2



Fig 117 Tenaculums for eye muscles



Fig 118 Weber's loop



Fig 119 Spoons

*a*—David's, *b*—Graefe's



Fig 120 Ophthalmic curettes

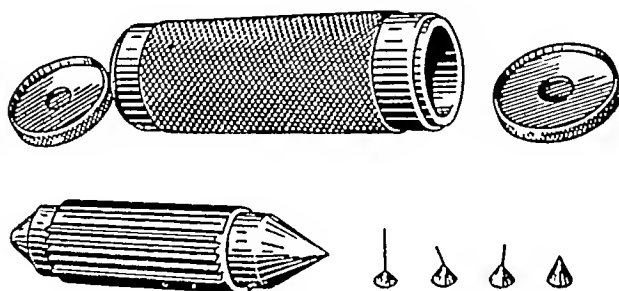


Fig 121 Ophthalmic magnet

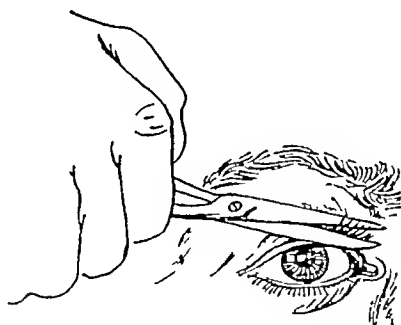


Fig 122 Cutting off lashes

should be cut off (Fig 122) Artificial teeth, necklace, etc , should be taken off the patient before the operation

Care of the patient after operation with opening of the eyeball should be especially thorough The nurse should strictly watch the patient's condition after removal of cataract, after keratoplasty, antiglaucomatous operations, operations for detachment of the retina Postoperative care includes immobilization of the head, preventive measures

against vomiting, coughing, etc. The patient should not leave his bed for a time that is determined by the physician in each particular case. A cleansing enema should be given to patients in case of constipation. If urine is retained, a hot water bag should be placed on the bladder. If this does not help, catheterization is necessary. In 6-8 hours after the operation the nurse gives the patient liquid (or pasty) food taking measures to prevent coughing or choking.

*Postoperative tactics of the nurse* After operation, especially on the first day postoperative, the patient may complain of pains, the bandage may soak in blood, bleeding may be renewed, and the patient may vomit. The nurse must be especially concerned by these symptoms.

Pains often develop during the first hours postoperative when the anaesthetics become no more effective. Amido-pyrine or promedol should then be given.

If vomiting begins, the patient's head should be turned to its side and bent slightly over a basin or tray.

If the bandages become soaked in blood (for example, after extirpation of the eye), new bandage should be added. Bleeding after intraocular operations, especially after removal of the cataract, or antiglaucomatous operation attended by vomiting and bradycardia, are alarming symptoms of the most dangerous complication, expulsive bleeding. A physician on duty should immediately be summoned and an urgent operation done to save the eye.

After bandaging both eyes, aged patients may develop depression or severe excitement attended with delirium and hallucinations. The intact eye may then be released from the bandage. This shall only be done to a special order of the physician.

**Nurse's duties in the operating room** The most important duty of a nurse working in an operating room is to maintain aseptic conditions to rule out possible grave complications that may arise due to infection and thus spoil the results of the operation and cause destruction of the eye.

The duty of the nurse is to take care of the ophthalmic tools and instruments, to prepare dressing material and clothes, to sterilize tools, and the suturing material. She also prepares the operating table. During operation she performs the duties of a scrub nurse, handing instruments to

the operating surgeon and receiving used one. Before handling a tool, which will be introduced into the eye, it should be dipped in boiling water. No cotton wool fibres, hairs or the like should be present on such tools.

*Preparing suturing and dressing materials:* Gauze and cotton wool pads are made by cutting out two round pieces of gauze and placing loosened cotton wool between them.

*Cotton wool tampons* are used to dry the wound during operation. They are prepared as follows. Cotton wool is wetted in furacin solution (1:5000), excess fluid is pressed out, cotton wool is spread in layers, and each is rolled into a dense rod on a glass. The long rod is then cut into 4-5 cm long tampons.

*Sterilization of silk.* Silk is wound on glass bobbins or slides (without tension) and dipped into a boiling 0.5% brilliant green solution and boiled for 4-5 minutes (depending on thickness). After boiling the silk is removed from the solution by sterile forceps and transferred into a bottle containing 96% alcohol. Thus sterilized silk may be used not earlier than in 24 hours.

*Sterilization of catgut.* Catgut is wound in coils, tied up by a thick thread and placed in a bottle containing 1% aqueous solution of brilliant green. The bottle is placed in a thermostat and kept there at a temperature of 37° C for 24 hours. Using a sterile forceps the catgut is transferred into a bottle containing 96% alcohol which is again placed in a thermostat for 24 hours. Catgut should be stored in 96% alcohol.

*Preparing suturing material from albino rat tail tendons and its sterilization.* The tail is first washed and disinfected in a 3% chloramine solution. The skin is then removed from the tail, the vertebrae are broken, and the tendons extracted by forceps. The tendons are kept in a 70% alcohol for two days and then transferred into a solution containing 1 ml of pure iodine and 1 ml of potassium iodide in 100 ml of alcohol where they are kept for another 24 hours. The tendons should be stored in 96% alcohol.

*Duties of a nurse in a dressing room.* The role of the nurse in the care of patients operated inside the eye and in the dressing manipulations is very important. Efficacy of her manipulations depends on aseptic performance of her duties.

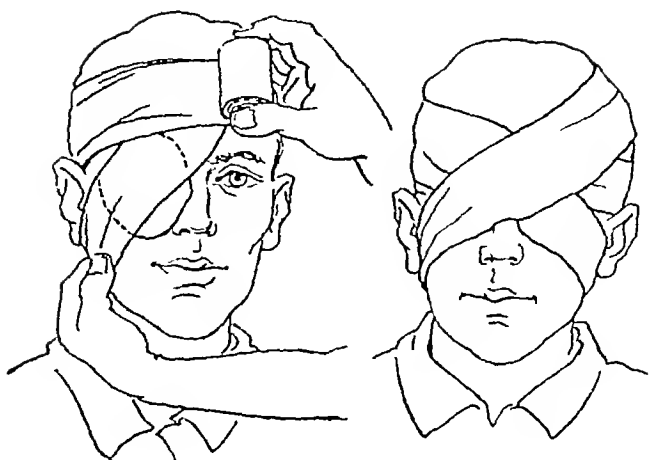


Fig 123 Bandages  
a—monocle, b—binocle

and accuracy of carrying out physician's prescriptions. The nurse bears all responsibility for the medicines kept on the dressing table, and for all manipulations performed in the dressing room. Preparing dressing materials and tools is another duty of the nurse. Special care should be taken in instillation of drops and application of ointments in the postoperative period.

**Applying bandage.** A bandage is placed on the operated eye to protect it from external effects and to give rest and warmth. Bandage applied to one eye only is known as monocle bandage, and on two eyes, binocle (Fig 123). Binocle bandage is normally used after extraction of the cataract, antiglaucomatous and some other operations. A soft white gauze (6-7 cm wide) is used. The eye is covered with a gauze and cotton wool pad which is fixed by a turn of the bandage (round the forehead, with the gauze being unrolled in the direction of the intact eye). The bandage is then passed under the ear on the side of the operated eye and the pad is now covered by bandage from the nasal side. A next turn of the bandage covers the pad from the side of the temple. A turn of bandage is now passed round the forehead again and the intact eye is bandaged in the same order. Fixing the pad with adhesive tape is a convenient and economic way. The





## Chapter 4

# Examination of Patients with Diseases of the Eye

### COMPLAINTS AND ANAMNESIS

The first acquaintance with the patient begins at the moment he enters the study of the doctor. His gait, the position of the head, the face countenance and expression are also considered.

The following complaints are characteristic of the eye diseases

- decreased visual acuity or other visual disorders,
- pain or discomfort in the eye,
- changed appearance of the eyelids, the orbit, or the eyeball,
- vertigo and double vision (diplopia),
- evadation and lacrimation

In each particular case it is necessary to clear out if the patient noticed impairment of his vision accidentally by closing one (intact) eye or at a moment by special examination. It is important to know if the faculty of vision has deteriorated suddenly or the process was slow and gradual. The nurse should be especially careful to patients in whom vision was impaired suddenly. She should direct him to the doctor and if the latter is absent, to an ophthalmological institution.

It should be remembered that a sudden impairment of vision may be associated with dysfunction of other vital organs and systems outside the eye, e.g. with cerebrovascular disorders. The patient should then be examined by other specialists (therapist, neuropathologist).

Other disorders of vision may be manifested by the following objects are seen as distorted in shape (metamorphopsia), this is often associated with astigmatism, pathology of the yellow spot, detachment of the retina,

iridescent circles are seen when the patient observes the source of light. The patient should be examined for glaucoma, but this may

also be the first sign of cataract or inflammatory oedema of the cornea; colours are perceived imperfectly (chromatopsia) This may arise due to chorioretinal affections or changes in the lens,

spots and filaments are seen by patient, which can move with the movement of the eye These may be due to opacity in the vitreous body and require no special treatment, but sometimes these signs are associated with changes in the retina These may also be reflexes of foreign bodies,

field of vision changes Defects of the visual field develop in retinal or nerve affections,

significant deterioration of twilight (night) vision This may be congenital (pigment dystrophy of the retina) or acquired (vitamin A deficiency, acquired atrophy of the optic nerve)

**Pain and discomfort in the eye** Some diseases of the eye are attended with pain and headache Pains should be differentiated from pains of other genesis irradiating into the eye (intracranial diseases, etc )

Acute localized pain which is intensified by the movement of the eyes or the eyelids may indicate the presence of a foreign body Sometimes strong pain in the eye may be due to increased intraocular pressure This may be attended with nausea and vomiting

Acute pain may be a symptom of increased strain in the eye but a more common cause is inflammation of the eyelids or the conjunctiva and minor foreign objects Itching is a common and specific sign of ophthalmoallergy

Photophobia may develop in persons with deficit of the pigment in the iris and choroid of the eye (in albinos) Sometimes it develops in neurasthenic persons Photophobia is especially pronounced in keratitis, uveitis, and foreign bodies of the cornea

**Exudation and lacrimation** Purulent exudate usually indicates the presence of bacterial infection Increased lacrimation may attend inflammatory processes in the conjunctiva and the cornea, obstruction of the lacrimal ducts, and other disorders Dryness of the eye (xerophthalmia) occurs in aged persons and in patients with collagenosis

### Examination of the Patient

The patient's eyes are first inspected in the daylight The patient is seated in a chair, facing the window so that the illumination be uniform A certain sequence should be ob-

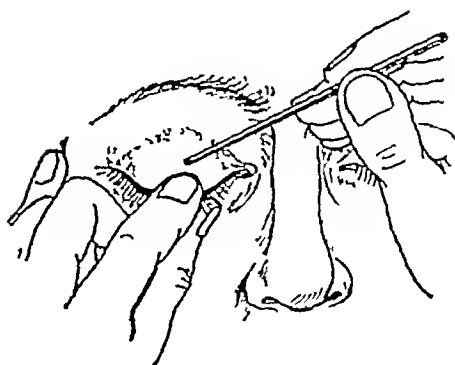


Fig. 124. Turning out the eyelid (1st movement)

served in examination the eyelids and the surrounding tissues are first inspected. Attention is paid to the width of the lid slit, angles of the eyelids (it should be remembered that fissures at the temporal canthus of the eye are very painful), the position of the eyelids, the condition of the eyelashes, margins of the eyelids, etc. The lacrimal apparatus (the lacrimal glands, lacrimal puncta, and the lacrimal ducts) is then examined. If the lacrimal sac is inflamed, fluid (sometimes purulent) may be expressed from the lacrimal puncta by pressing in the region inferiorly and medially to the nasal canthus of the eye. The mucosa should be inspected next. The patient is directed to look upwards while the examiner pulls the lower eyelid down to expose the conjunctiva. The manipulations of the examiner should in all cases be very gentle and sparing to avoid injury. When the upper eyelid conjunctiva is inspected, the patient should look down, while the examiner should pull the upper eyelid (by the forefinger and the thumb of the left hand) slightly anteriorly and inferiorly (Fig 124). Simultaneously, the skin of the eyelid at the point between the eyelid margin and the brow should be depressed by the thumb of the right hand, or by a glass rod, to displace the upper edge of the cartilage downwards, and the eyelid margin upwards (Fig 125). The conjunctiva of the cartilage becomes exposed to the examiner (the upper portion of the eyelid is now below the lower margin). In order to examine the conjunctival fornix, the upper eyelid should be held everted and the eyeball

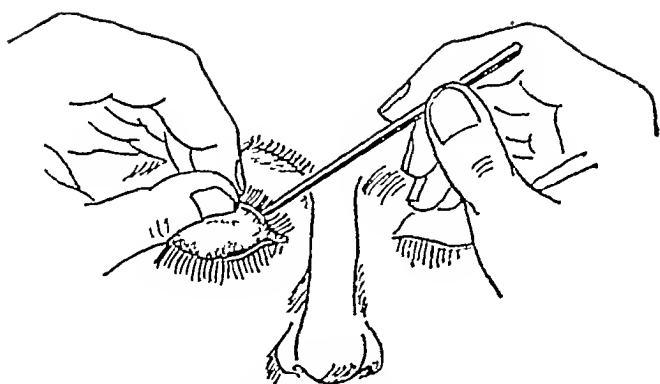


Fig. 125. Turning out the eyelid (2nd movement)



Fig. 126. Exposing the superior conjunctival fornix

pressed carefully through the lower eyelid into the orbit (Fig 126) the pressure in orbit will increase and the palpebral conjunctiva of the fornix will be exposed. Examination of the conjunctival fornix is especially important in trachoma, because the changes characteristic of this disease appear in this region. Foreign objects may be caught in the depression of the conjunctival fornix as well. The examination should be especially careful if the patient complains of the feeling of a foreign object behind the eyelid. If the eyelids are tightly pressed together, it is recommended to instill a 0.5% dicaine (anaesthetic) solution into the conjuncti-

val sac. Examination of infants and children is especially difficult. If a baby resists the examiner it should be laid on his back, the head immobilized between the nurse's laps (a towel should be used), and someone (for example the mother) should hold the baby's legs and arms, pulling them downwards. In some cases the baby may be narcotized.

The cornea should be inspected next. The examination should be carried out first in the daylight, and then with focal or lateral illumination. To that end, using a 130 D or 200 D lens, the rays of light are concentrated on the cornea. The source of light should be at the left of the patient, at the level of the eye. Opacity and other changes will be clearly seen on an affected cornea.

The condition and the contents of the anterior chamber should be examined with lateral illumination. The chamber is deep in the absence of the lens or in its traumatic dislocation. The chamber is shallow in acute attack of glaucoma and penetrating wound of the cornea.

It is very important to establish the shape and the width of the pupils. Inequality of the pupils in diameter (anisocoria), and also abnormal narrowing or dilation of the pupils is characteristic of nervous diseases, poisoning, etc. The pupil may be abnormally dilated due to intake of medicines, e.g. atropine, while instillation of pilocarpine narrows the pupil. The examiner should therefore ask the patient if he did not instill any eye drops or took some medicinal preparations. The pupil is known to narrow in light and dilate in the dark. The reaction of the pupil to light is very important. The absence of response to light in most cases would indicate blindness. Direct reaction of the pupil to light is tested as follows: the patient is seated at the window and asked to look forward (at far-off objects). The eyes are now screened by the palms (they should remain open). The right and the left palms are now removed successively: a vivid reaction of the eye indicates the absence of diseases. In dubious cases the eyes should be tested in the dark room. The patient is directed to look in front of him, away from the source of light. Using a magnifying lens a beam of light is directed straight into the eye pupil. The pupil region where the lens is located should then be inspected. If the lens is clear, the pupil remains black.

## Special Methods of Examination

Examination of the eye with a passing light is carried out by an ophthalmoscope (Fig 127) A simplest ophthalmoscope is a perforated concave mirror, but various modifications of this instrument are now available

The operating principle of this tool is that a beam of light from a source in front of the patient passes the pupil and refracts in the optic mediums to fall on the retina. Obeying the law of conjugated focuses, the beam is reflected from the retina to return through the same refracting mediums of the eye to the source of light, if the source of light is located behind and to the left of the patient, while the concave mirror with the perforation at the centre is located in front of the examiner's eye, a beam of light reflected from the mirror into the eye of the patient will return from the patient's eye to pass through the hole in the mirror and get into the examiner's eye who will observe the red colour of the pupil (which depends on the reflection of the light from the retina, the blood vessels of the choroid, and also on the colour of the retinal pigment) Direct and indirect ophthalmoscopy are used for examination of the eye interior The procedure is carried out in a dark room The source of light (an opaque 75-100 W incandescent lamp) is installed at the left side of the patient, at the level of his eye, while the examiner

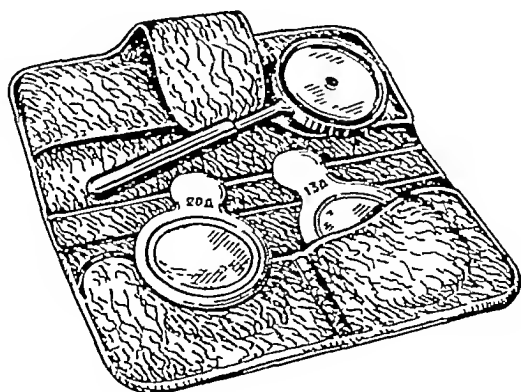


Fig 127 An ophthalmoscope

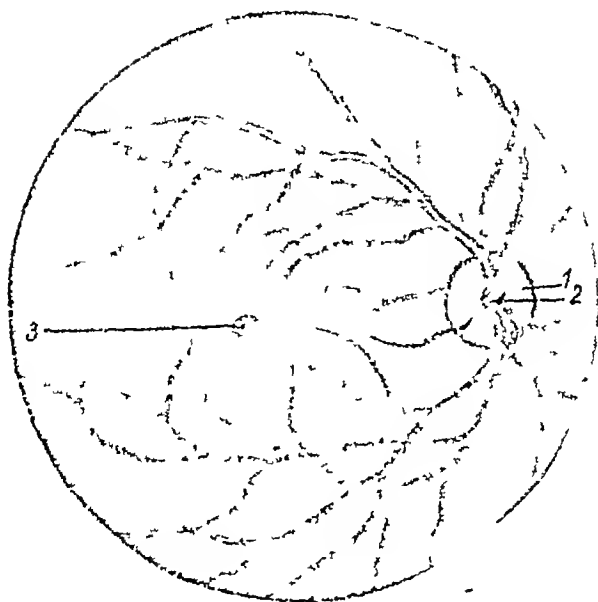


Fig 128 An ophthalmoscopic picture of a normal eye bottom  
1—optic disc, 2—central retinal vessels, 3—yellow spot

assumes his position at a distance of 50 cm, opposite the patient

*Indirect ophthalmoscopy* is done with a double convex lens (13.0 D) and a concave mirror. The lens is installed in front of the eye, at a distance of 7.7 cm. The light rays pass from the source of light, fall on the mirror, are reflected from it, and enter the patient's eye. The rays are reflected from the eye bottom, fall on the ophthalmoscope lens, and are refracted in the lens to give a real enlarged inverted image of the eye interior which the examiner observes through the hole in the mirror. A normal picture of the eye bottom is given in Fig 128.

*Direct ophthalmoscopy* is based on the law of conjugated focuses. When the examiner obtains a red reflection of the eye bottom through an electrical ophthalmoscope (the handle of the instrument contains a source of bright light), he moves his eye toward the eye of the patient until a clear



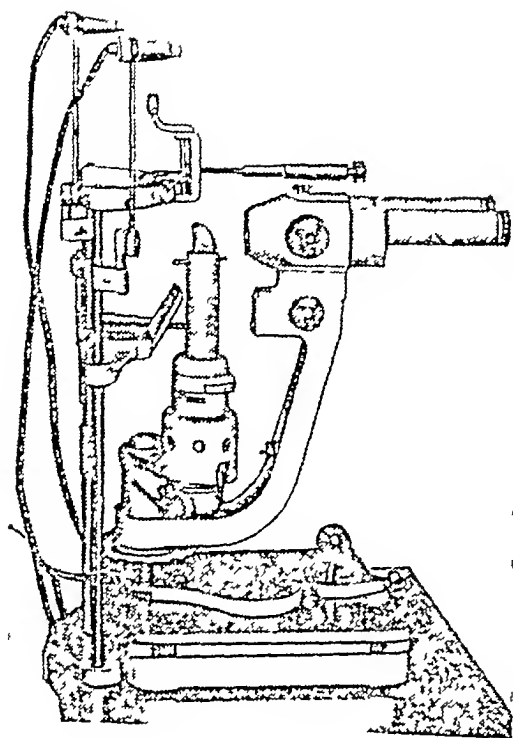


Fig 129 A slit lamp

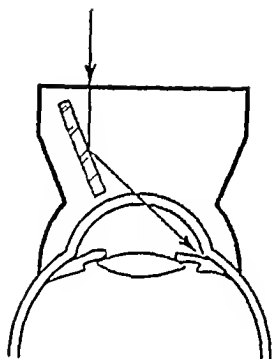


Fig 130 A diagram of gonioscopy

image of the eye bottom is obtained (the examiner positions his eye in the conjugated focus where the rays of light reflected from patient's eye bottom are collected) It is important that the refractive power of the examiner and examinee eyes be the same This can be attained by optical glass inserted in the disk placed behind the perforation of the refraction ophthalmoscope

Direct ophthalmoscopy gives a virtual upright image enlarged 15-16 times, which makes it possible to regard in detail the eye bottom, and accounts for the main advantage of the method

Ophthalmoscopy is used to observe changes in the retina, optic nerve, and the choroid Ophthalmoscopy is therefore an important tool not only in diseases of the eye but in neu-

rological examinations, and in the diseases of the cardiovascular system, hypertension, and in some other diseases Biomicroscopy is a further improvement of the lateral illumination technique which makes it possible to examine the changes in the eye tissues at various magnification. The method is based on the contrast of a focused light beam passing through an unilluminated space (like a beam of light illuminates dust particles as it penetrates a shaded room through a hole in the curtain).

Biomicroscopy is carried out with a slit lamp (Fig 129). Gonioscopy is intended to examine the angle of the anterior chamber, which is necessary in glaucoma, suspected foreign bodies within the angle of the anterior chamber, tumours, etc. Common biomicroscopy fails to examine the angle of the anterior chamber, and special lenses and gonioscopes are therefore used (Fig 130).

### *Review Questions*

- 15 Can vision be suddenly lost due to cerebrovascular disorders?
- 16 Iridescent circles are only seen by a glaucoma patient as he looks at the source of light. Yes or no?
- 17 What drops should be instilled into the eye if the lids are pressed tightly together?  
(1) 20% sulphacetamide solution, (2) 0.5% tetracaine hydrochloride solution
- 18 The conjunctival fornix of the upper eyelid should be examined if the patient feels a foreign body on the cornea.  
Yes or no?

## Chapter 5

# Basic Methods of Treating Diseases of the Eye

Various medicinal preparations are used to treat diseases of the eye. They may be conventionally divided into medicines that are used for general therapy and those intended for local application.

### GENERAL THERAPY

The main indications for general therapy are inflammatory processes of the orbit and the eye appendages (lacrimal ducts, eyelids, muscles), and also general pathological process or affection of other organs concurrent with the diseases of the eye and its appendages. Antibiotics, sulpha drugs, vitamins and other preparations, that may be given per os, intramuscularly, intravenously or intra-arterially, are used in general therapy.

*Sulpha drugs* Sulphadimidine, sulphaethidole, etc., are widely used. Sulphadimidine (0.5 g) is given three times a day (one or two tablets). Ample water and alkali are recommended together with this preparation. The drug should be taken for 5-7 days.

Sustained-action sulpha drugs (depo-sulphanilamides) are now successfully used. They are less toxic and readily penetrate all tissues of the body (except the cerebrospinal fluid). This group of drugs includes sulphamethoxypyridazine, sulphadimethoxine, etc.

Sulphamethoxypyridazine is given as follows: 1-2 g during the first day to adults, with reduction to 1.0-0.5 g each next day. The dose to children should be reduced according to their age. The average length of the course, 5-7 days. The drug is well combined with antibiotics.

*Antibiotics* Many various antibiotics are used in ophthalmology. Those which are more commonly used in therapy of eye diseases are given in Table 2

Table 2

## Main Antibiotics Used in Ophthalmology

Antibiotics	General use		Local use		
	per os	Intramuscularly	drops	ointment	subconjunctival injection
Benzylpenicillin, potassium and sodium salts		200 000-300 000 U 4-6 times daily	10 000 U/ml	10 000 U/g	25 000 U
Tetracycline hydrochloride	100 000 U 3-4 times daily	50 000-100 000 U 1-2 times daily	10 000 U/ml 3-6 times daily	10 000 U/g 2-6 times daily	
Erythromycin	100 000-250 000 U 4-6 times daily			10 000 U/g 2-5 times daily	
Streptomycin sulphate		250 000-500 000 U 2 times daily			
Nystatin	500 000 U 3-4 times daily		10 000 U/ml 4-5 times daily		

It should be remembered that complications in the eye may arise in combined use of antibiotics and sulpha preparations. These may be oedema of the eyelids and of the scleral conjunctiva, inflammation of the optic nerve, haemorrhage into the retina, etc., which usually subside after suspension of the drug therapy.

Toxico-allergic reactions are also possible in antibiotic therapy. The patient should therefore be asked if he had any complications with antibiotics or sulpha therapy in the past. Special care should be taken if the patient has signs of general allergic susceptibility. General antibiotic therapy should be given at a hospital.

A toleration test should first be made. 0.1 ml of the antibiotic should be injected intracutaneously in the skin of the forearm (The concentration of each tested antibiotic is specified in the relevant instructions). The results are evaluated in 20 minutes. Infiltration in the skin sizing over 10 mm (with hyperaemic zone round the infiltration) is considered positive and the antibiotic shall not be administered to the patient.

Of other anti-inflammatory drugs, amidopyrine (0.25-0.5 g) or butadione (0.15 g) are given three times a day (in iridocyclitis in particular). The course of therapy, 2-5 weeks.

Purposeful treatment is indicated to patients with tuberculous, toxoplasmic, and rheumatic, and other affections of the eye. In tuberculous affections the patients are given phthivazid (0.3-0.5 g 3-4 times a day), PASA (0.5-1 g 4-5 times a day), usually in combination with streptomycin injections.

In cases with eye toxoplasmosis, aminoquinol is given, 0.1-0.15 g three times a day, in ten-day cycles at 10-12 day intervals (3-4 cycles), other preparations are also given.

Glucocorticosteroids (cortisone, 0.0125-0.025 g 3-4 times a day, 3-4 g per course) and other preparations are given together with amidopyrine and butadione in cases with rheumatism.

Vitamins are very important in the treatment of eye diseases. They give positive effect in various processes in the eye (metabolic, regenerative, etc.). Vitamins, A, B<sub>1</sub>, B<sub>2</sub>, C, E, P, PP and others are widely used in ophthalmological diseases.

*Vitamin A* favours normal metabolism, improves nutrition of the corneal epithelium, neuroepithelium of the retina, and also promotes regeneration of the visual purple. *Vitamin A* (dragee, oil solution, cod-liver oil) is given per os in keratomalacia, xerophthalmia, hemeralopia, etc. Acetate and palmitate of vitamin A are produced in ampoules for intramuscular injections.

*Vitamin B<sub>1</sub> (thiamine)* favours conduction of the nervous impulse in synapses, and produces positive action on the nervous-trophic processes. It is given in 0.02 g doses per os or intramuscularly as a 5% solution (1 ml every other day).

to treat neuritis and atrophy of the optic nerve, neurotrophic disorders associated with herpetic keratitis, glaucoma, and other diseases

*Vitamin B<sub>2</sub> (riboflavin)* is involved in tissue metabolism and is a factor of body resistance to infectious diseases, it increases dark accommodation. The preparation is given in powder or dragee (0.002 g) to treat hemeralopia, early cataract, and some other diseases.

*Vitamin C (ascorbic acid)* is involved in regulation of reduction-oxidation processes, capillary permeability, regeneration of tissues, etc. Given in 0.1-0.3 g powders or tablets in haemorrhage in the eye membranes and the vitreous body, early cataract, burns, degenerative changes in the cornea and other diseases, a 1% solution of the acid in 40% glucose solution may be injected intravenously (for indications).

*Vitamin P (rutin)* is given in combination with ascorbic acid (ascorutin) in a dose of 0.02 g to decrease permeability and fragility of capillaries.

*Vitamin PP (nicotinic acid)* is used as a vasodilating preparation (0.02 g per os or 1% solution for injection) in various diseases of the retina, the optic nerve, glaucoma, etc. Side effects may develop from intake of vitamin PP: reddening of the face and the upper portion of the body, vertigo. Better tolerated is nicotinamide which produces similar action when given in the same doses.

*Vitamin E* decreases "oedema" and improves blood circulation in the retina, has an antisclerotic effect on the vessels. Used in inflammatory and dystrophic processes of the retina, in keratitis, and other diseases.

*Anti-allergic preparations* To suppress biologically active substances (mediators) which are formed at the pathochemical phase of the allergic reaction, antihistaminic preparations are used, such as dimedrol, pipolphen (0.5 g for an intake), etc. These are prescribed in allergic conjunctivitis, iridocyclitis, medicamentous complications, etc. Calcium gluconate in tablets (0.5 g, three times a day, for a month) is given as a desensitizing preparation.

Diuretics, diacarb and dichlothiazide, have also a hypotensive effect and are used to decrease intraocular pressure in glaucoma. Diacarb is given in 0.15-0.25 g and dichlothia-

zide in 0.025 g doses per intake in combination with miotics (see below)

Intramuscular or subcutaneous administration of aloe extract, Fibs, and other biogenic stimulants (1 ml daily in the course of a month) is given in some diseases to stimulate metabolic processes

The specific features of eye pathology account for a wide local application of medicinal preparations

### Local Use of Medicines

Local application of medicinal preparations includes irrigation, instillation of solutions and suspensions, applying ointments and ophthalmic inserts to the conjunctival sac (Fig. 131), subconjunctival injections, electrophoresis with some medicinal preparations, etc

Instillation of drops is the most common local treatment. The patient is directed to look up, his lower eyelid is pulled down by a wet cotton wool tampon held in the left hand while the pipette is held in the right hand. The tip of the pipette should not touch the eyelashes, eyelids, or the mucosa of the eye (Fig. 132). One or two drops of the solution or suspension are expressed from the pipette into the inferior conjunctival fornix.

Irrigation of the conjunctival sac by a liquid jet is indicated in burns, foreign bodies, exudation, etc. A special

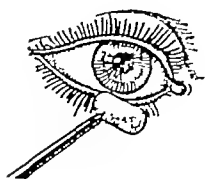


Fig. 131 Applying an ophthalmic insert

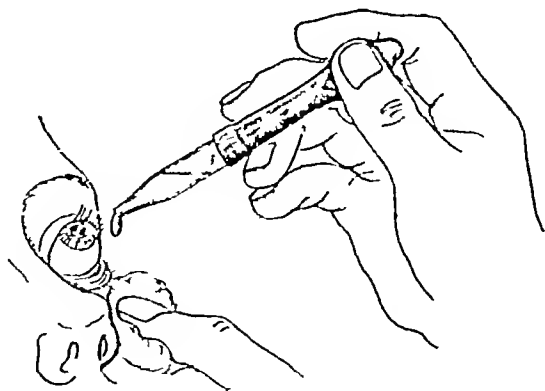


Fig. 132 Instillation of drops

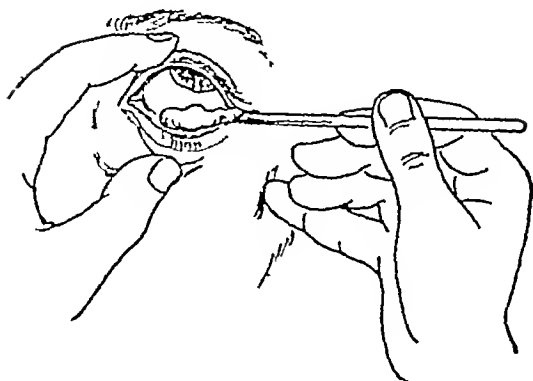


Fig 133. Applying ointment

undine or rubber syringe is used for the purpose. A small glass (with blunt margins) filled with a medicinal solution is used for direct washing of the eye.

Ointment is applied as follows. The eyelids are separated by the thumb and the forefinger of the left hand, a glass rod with the ointment is placed on the inner surface of the lower eyelid, the patient is directed to close the eye, and the rod is now gently pulled out from the eye (Fig 133). Sparingly soluble medicines are usually administered as ointments.

*Wet treatment of the eyelid margins.* A piece of sterile cotton wool is wound round a thin probe, dipped in the medicinal solution, excess liquid is pressed out and the lid margins are treated with thus prepared tampon.

Subconjunctival injections are carried out after preliminary anaesthesia of the eye by triple instillation of 0.5% tetracaine hydrochloride solution. Antibiotics, procaine hydrochloride, cortisone, and other medicines are thus injected. The dose of the solution, 0.2-0.3 ml.

Electrophoresis with medicinal preparations ensures longer (compared with instillation) action of the drug on the focus of pathology. Electrophoresis on the closed eyelids, baths, and endonasal electrophoresis are used in practical ophthalmology.

Electrophoresis of the closed eyelids is a modification of the Bourguignon method. It consists in the following: a cotton wool tampon wetted with the medicinal solution is placed into the lower conjunctival fornix. The indifferent



electrode is a plate of rolled lead, sizing  $6 \times 10$  cm, provided with a textile lining. It is placed on the neck and fixed by an elastic bandage. The current density is to 2 mA, the procedure continues for 10-20 minutes.

**Bath electrophoresis** The medicinal preparation is filled in the bath (electrode) and the latter is fixed in place by an elastic bandage.

**Endonasal electrophoresis** Cotton wool wetted in the medicinal solution is wound round the active electrode ends, while the indifferent electrode is fixed on the back of the neck.

Depending on the action of preparations, they may be divided into the following groups

### Anaesthetics

*Tetracaine hydrochloride (dicaine)* A strong local anaesthetic. Its action begins in 2-3 minutes and persists for 10 minutes. A 0.5% solution is normally used. Some persons exhibit increased sensitivity toward the preparation (dermatoconjunctivitis).

*Cocaine hydrochloride* Used as a 1%, 2% and 3% solution. The anaesthetic effect develops in 3-5 minutes. It acts as a vasoconstrictive drug to cause the pupil to dilate. Its effect on the cornea is negative (desquamation of the epithelium).

*Procaine hydrochloride* Used as a 1-2% solution for injection anaesthesia.

### Miotics

The miotics are divided into two main groups by their mechanism of action. They are often used in combinations with one another in order to ensure the hypotensive effect in glaucoma patients.

### Cholinomimetics (Group I)

*Pilocarpine hydrochloride* Used as a 1-6% solution and 1-5% ointment, and also as ophthalmic inserts in glaucoma, thrombosis of the central retinal vein, etc.

*Acceclidine* It is superior to pilocarpine as regards its strength and duration of the miotic effect Used as a 2-3 % and 5 % solution or ointment

*Carbachol* Used as a 0.5-1 % solution. Its miotic effect is similar to that of pilocarpine

### *Cholinesterase Inhibitors (Group II)*

*Physostigmine salicylate* Used as a 0.25-1 % solution It is stronger than pilocarpine but some patients develop pain in the eye due to a sharp accommodation spasm

*Phosphacol* Used as a 0.02 % solution Its miotic strength several times exceeds that of physostigmine Its side effects are the same

*Armine* Used as a 0.005 % solution

*Pyrophos* Used as a 0.02 % oil solution This preparation, as well as the previous two, are only given for special indications.

### **Mydriatics**

Mydriatics are used for both diagnostic (examination of the eye bottom, determination of refraction) and therapeutic purposes (immobilization of the pupil, prevention of commissures between the iris and the lens in iridocyclitis and of commissures between the iris and the cornea in penetrating injuries)

Mydriatics are contraindicated in glaucoma because they increase intraocular pressure

*Atropine sulphate* Used as a 0.5-1 % solution or ointment Mydriasis develops in 15 minutes in a healthy eye and persists for several days (sometimes over a week)

*Scopolamine hydrobromide* Used as a 0.25 % solution or ointment In its action it is similar to atropine, and is well tolerated by patients Increases intraocular pressure

*Homatropine hydrobromide* Used as a 0.25-0.5 % and 1 % solution, mainly for diagnostic purposes, because it promptly causes mydriasis which persists for 10-20 hours

*Ephedrine hydrochloride* Used as a 2 % solution Recommended for dilation of pupils in persons aged over 40 because it does not increase intraocular pressure

*Benactyzine* As a 1-2% solution it causes a strong but transient mydriatic effect Useful for diagnostic purposes

*Adrenaline hydrochloride* Used as a 0.1% solution for instillations, subconjunctival injections, and applications It also has a pronounced vasoconstrictive effect

### Sulpha Drugs and Antibiotics

These are widely used as drops and ointments for treatment of infectious diseases of the anterior eye (blepharitis, conjunctivitis, purulent ulcers of the cornea, etc.) and for prophylaxis of postoperative complications

*Sulphacetamide sodium* Used as 10%, 20% and 30% solutions or ointments

*Sulphamethoxypyridazine sodium* Used as 10-20% aqueous or polymer solution, and also as ophthalmic inserts

*Sulphaethiodole* Used as a 5% ointment

When prescribing antibiotics it is necessary to remember that resistance of microorganisms to some widely used antibiotics such as penicillin, streptomycin, tetracycline, etc., has increased

Dosage of antibiotics recommended for local use is given in Table 2 (see above)

### Corticosteroids

These have strong anti-inflammatory and antiallergic effects (immunodepressants) Used for treatment of allergic conjunctivitis, scleritis, iridocyclitis, and other diseases Contraindicated in disorders of the epithelial layer of the cornea (to prevent ulceration)

*Hydrocortisone* Used as 0.5-2.5% suspensions or ointments

*Prednisolone* Used as a 0.5% ointment

### Antiviral Preparations

*5-Iodine-2-desoxyuridine* Widely used as a 0.1% aqueous solution (kerecid) for treatment of herpetic keratitis Indicated in acute stage of the disease (2 drops, 6-8 times a day)

*Oxoline, trebrofen, and fluorenal* These are Soviet-made preparations, used as 0.1-0.25% ointments, 3-5 times a day to treat herpetic and adenoviral diseases of the eye

*Interferon* Has a non-specific antiviral effect Used as drops, 6-8 times a day, to treat herpetic and adenoviral diseases of the eye, and also as subconjunctival injections in the therapy of deep herpetic keratitis

### *Vitamins*

Vitamins are used for general stimulation of metabolic processes in early cataract, persistent blepharoconjunctivitis, keratitis, and other diseases

*Riboflavin* Sparingly soluble in water and alcohol Used in 0.02% concentration

*Citral* In its chemical structure it is similar to the lateral chain of vitamin A molecule Used as a 0.02% solution for drops (2-3 times a day)

*Viccin* (combined preparation) Used for treating early cataract, contains cysteine and some other medicinal substances

### *Astringents and Cauterants*

Astringents contract blood vessels, decrease hyperaemia of tissues, and decrease sensitivity to pain When in high concentration, they are used as caustics and bactericidal preparations

*Zinc sulphate* Used as a 0.25-1% solution in treating angular conjunctivitis

*Silver nitrate* A 1-2% solution is used as a caustic (cauterant) for prophylaxis of gonoblenorrhoea Conjunctiva blackens after prolonged use of the preparation

### *Other Preparations*

*Brilliant green* A 1% per cent alcoholic solution is used to treat wounds on the eyelid margins, in blepharitis, and to disinfect the operation field and the hands of the surgeon before operation

*Boric acid* A 2% solution is used for irrigation of the eye

*Mercuric oxycyanide and potassium permanganate solutions* (1:5000) are used for irrigation of the conjunctival surface of the eye

*Mercuric oxide (yellow) ointment* Used in 1-2% concentration as resolving preparation

*Fluorescein* Used as a 0.5-1.0% solution for detecting defects of the corneal epithelium

Below follow some common prescriptions for medicines used to treat eye diseases

### *Sulpha Drugs and Antibiotics*

- Rp Sol Sulfacyli-natrii 20%, 10.0  
D S Eye drops, instill two drops t d s in both eyes
- Rp Sulfacyli-natrii 3.0  
Vaselinii ophthalmici 10.0  
M D S Ophthalmic ointment, applied to the conjunctiva of both eyes, two times a day
- Rp Benzylpenicillini-natrii 100 000 U  
Aq destill 10.0  
M D S Eye drops, two drops in both eyes, four times a day
- Rp Streptomycini sulfatis 0.5  
Aq destill 10.0  
M D S Eye drops, instill two drops t d s into the left eye
- Rp Linimenti Synthomycini 1% 10.0  
D S eye ointment, apply to conjunctiva of the right eye two times a day
- Rp Ung Tetracyclini ophthalmici 1% 5.0  
D S Eye ointment, apply to conjunctiva of both eyes 3-5 times a day.

### *Mydratics*

- Rp Atropini sulfatis 0.1  
Aq destill 10.0  
M D S Eye drops, instill two drops in both eyes, t d s
- Rp Scopolamini hydrobromidi 0.025  
Aq destill 10.0  
M D S Eye drops, instill two drops into the right eye two times a day
- Rp Homatropini hydrobromidi 0.1  
Aq destill 10.0  
M D S Eye drops, instill 2 drops in both eyes, once in the morning

### *Miotics*

- Rp Pilocarpini hydrochloridi 0.1  
Aq destill 10.0  
M D S Eye drops, instill 2 drops in both eyes, t d s

- Rp Carbacholini 0 05  
 Aq destill 10 0  
 M D S Eye drops, instill 2 drops in the right eye for night
- Rp Physostigmini salicylatis 0 05  
 Sol Acidi borici 2% 10 0  
 M D S Eye drops in vitro nigro, instill 2 drops in both eyes  
 2 times a day
- Rp Sol Armini 0 005% 10 0  
 D S Eye drops, instill 2 drops in both eyes, once a day
- Rp Sol Phosphacoli 0 02% 10 0  
 D S Eye drops, instill 2 drops in the right eye once a day

### *Anaesthetics*

- Rp Dicaini 0 05  
 Aq destill 10 0  
 M D S Eye drops, instill 2 drops in the right eye once a day  
 for three days

### *Vitamins*

- Rp Sol Citrali 0 01% 10 0  
 D S Eye drops, instill 2 drops in both eyes 2-4 times a day
- Rp Ung Thiamini bromidi 0 5% 5 0  
 M D S Eye ointment, apply to conjunctiva of both eyes 2-3  
 times a day
- Rp Sol Riboflavini 0 01% 10 0  
 D S Eye drops, instill 2 drops in both eyes 2 times a day

### *Corticosteroids*

- Rp Ung Hydrocortisoni ophthalmici 0 5% 2 5  
 M D S Eye ointment, apply to conjunctiva of lower lid of the  
 right eye 1-2 times a day

### **Physical Treatment**

Various physiotherapeutic procedures such as x-rays, ultrasound, laser beam and other physical agents are used in ophthalmological practice. Among them are thermal procedures. Sollux, warming compresses, etc., these are used to dilate the blood vessels to ensure prompt resolution of indurations associated with inflammatory processes of the eye appendages and the anterior portion of the eye.

Warming of deeper tissues is ensured with UHF currents, which are prescribed in acute inflammatory processes in the eyelids, lacrimal system, and the cornea

Diadynamic currents have pronounced pain relieving effect, improve circulation of blood and stimulate trophic processes. Diadynamotherapy is indicated to patients with marked pain syndrome, photophobia, and also with persistent forms of diseases or their torpid course in keratitis, iridocyclitis, etc

Microwaves intensify the redox processes, improve trophic processes and metabolism in tissues. Microwave therapy is effective in iritis and iridocyclitis, keratitis and other diseases of the eye

Ultrasound produces a resolving effect and promotes better healing of ulcers, activates metabolic processes, increases permeability of cell membranes. Ultrasound therapy is used to treat cicatricial changes in the eyelids and conjunctiva, opacification of the cornea with residual infiltration, opacity and late haemorrhage in the vitreous body and other changes in the eye

Radiotherapy is widely used to treat eye diseases. These methods are effective in many malignant newgrowths of the eye. Ultrasoft Bucky's (grenz) rays are used to treat some inflammatory diseases of the eye

**Laser therapy.** Laser is a new source of light emission. The energy of light is used to coagulate tissues inside the eye without opening the eye membranes which gives new opportunities for treatment of the retinal detachment, glaucoma, and other diseases

**Cryotherapy.** Frost is widely used to remove cataracts (cryo-extraction). The tip of tool is frosted to the lens capsule. Cryotherapy is also used in treatment of some tumours. Cryo-application is superficial freezing of the eye tissues by a slight touch of a cryoextractor for a few seconds. Another application of cold does not imply a direct touch of a cryo-extractor but consists in holding it close to the surface of the eye. Both methods are used to treat diseases of the cornea

**Counter-attractive therapy.** Leeches and foot baths are used as distracting means. In eye diseases leeches are applied to the temple. The leeches should be removed from water 1-2

hours before application and placed in a dry glass. This will stimulate the leech to suck more effectively. The patient should be placed in bed and his hair on the temple should be removed by shaving. The leech is held in a test tube, with its head at the tube mouth, the test tube is put on the temple skin at the level of the eye slit, 2-3 cm away from the slit, and held thus until the leech starts sucking. The test tube may now be removed. Leeches should not be applied to the vein or temporal artery. The nurse should see to it that the leech does not move onto the eyelid (the more so onto the cornea) because it may cause damage to the eye. If the leech does not fall off spontaneously in 30-60 minutes it should be wetted with a hypertonic solution of sodium chloride (or table salt). If the point of bite bleeds, a pressing bandage should be applied because hirudin secreted by the leech acts as an anticoagulant.

### *Review Questions*

19. Is it necessary to carry out a tolerance test before giving antibiotics to the patient?
20. During instillation of drops into the eye the tip of the pipette should touch the mucosa of the eye, the eyelashes and the eyelid. Yes or no?
21. What is the concentration of tetracaine hydrochloride for local anaesthesia (1) 5%, (2) 0.5%?



## Chapter 6

### Diseases of the Eyelids and the Lacrimal Apparatus

Pathological changes in the eyelids, such as oedema, subcutaneous haemorrhage, and emphysema occur rather frequently. These may be symptoms of both local inflammatory process of the eye and of the other organs.

Oedema of the eyelids may be caused by various factors. Bilateral oedema of the eyelids indicates cardiovascular or renal disorders. The skin is pallid, tense, and painless. Oedema is more pronounced in the morning and lessens significantly during the course of the day. If oedema is allergic, it is attended with itching. The skin of the eyelids is scarlet or bluish-red in inflammatory oedema which attends acute inflammatory processes of the eyeball or its appendages, of the orbit, and the surrounding tissues (acute conjunctivitis, phlegmona of the orbit, or sty).

Congestive oedema occurs in acute spasm of the eyelids, thrombosis of the orbit veins and the veins of the cavernous sinus, and also in tumours of the orbit. The venous outflow is impaired and the skin of the eyelids becomes cyanotic, thickened sinuous veins are sometimes clearly seen in the skin.

Erysipelatous affection of the face may extend into the eyelids which become oedematous and painful, their skin hyperaemic, sometimes bullous, the eyes almost do not open. This disease, like some other acute inflammatory processes, such as furuncle of the brow or abscess of the eyelid, is attended with elevation of the body temperature, and the lymph nodes round the ear are enlarged.

Inflammatory diseases of the eyelid skin are treated by sulphur drugs (sustained-action preparations are especially effective). Antibiotics may be given intramuscularly. U-V rays on the skin of the eyelids and the face are useful too.

Oedema of the eyelids may be caused by various factors, and thorough examination of the patient by a therapist, otorhinolaryngologist, or other specialist is therefore required with subsequent treatment of the main disease that may cause oedema of the eyelids

Acute haemorrhage is caused by the injuries of the eyelids, the eyeball, or by significant elevation of the blood pressure (strong coughing, fit of epilepsy, etc.) In cases with traumatic compression of the chest, haemorrhage into the thick of both eyelids occurs (goggle effect). Haemorrhage into the lower eyelids is important as a diagnostic sign in fractures of the cranial base. Maximum care should be exerted in transportation of such patients. Haemorrhage in the form of maculae occurs in some general diseases

If the internal walls of the orbit are injured, air easily passes under the eyelid skin from the paranasal sinuses (due to the absence of fat in the subcutaneous connective tissue of the eyelid). Emphysema of the eyelids therefore often occurs. If air penetrates into the orbit, the eyeball becomes protruded (exophthalmos). A pressing bandage should be placed on the eye which will promote rapid resolution of the air-filled tumours. The patient should be examined by an otorhinolaryngologist in order to clear out the cause of emphysema and to prescribe the necessary treatment

#### DISEASES OF THE SEBACEOUS AND MEIBOMIAN GLANDS, AND THE CARTILAGE

Sty is a rather common disease of the eye. It is a purulent inflammation of the sebaceous gland at the margin of the eyelid or inside its depth. Sties are frequent in asthenic persons, suffering from avitaminosis, they occur after chills or due to staphylococcal infection of the orifice of the sebaceous glands. The main symptom of a sty is a sharp pain in the eyelid margin which becomes oedematous and hyperaemic. Pus by no means may be expressed from the focus since the infection may be propagated by the venous system of the orbit and thus cause thrombosis of the orbital veins and the cavernous sinus

*Treatment* Instillation of a 20% sulphacetamide solution or 10% sulphamethoxypyridazine solution, three times a day, applying 1% tetracycline or erythromycin ointments before night sleep UHF therapy is helpful at the initial stage of the disease In relapses, general strengthening therapy, polyvitamins, yeast, and hardening of the body (hiking, sports) are indicated

Chalazion is a painless tumour in the cartilage of the eyelid (isolated from the skin) It develops as a result of proliferative inflammation (granuloma) in the lobes of the meibomian gland

Surgical treatment (in outpatient conditions) is indicated as a rule

### DISEASES OF THE EYELID MARGIN

Inflammation of the eyelid margins (blepharitis) may be simple, squamous, and ulcerative

Simple blepharitis is manifested by hyperaemia of the eyelid margins and squamous by the formation of bright scales at the base of the eyelashes Itching and increased sensitivity to light, dust, smoke, etc are frequent symptoms

Ulcerative blepharitis is characterized by ulceration of the eyelash roots, which often become covered with pus crusts Eyelashes fall off or their growth from the eyelids becomes abnormal due to scars left by the healed ulcers The eyelashes may then rub the cornea of the eyeball The disease ends in formation of the scars, the eyelid thickens, and xerophthalmia and keratoleukoma develop which decrease the acuity of vision

Various endogenic and exogenic factors may cause the disease Sometimes this or that form of chronic blepharitis is a symptom attending other pathological processes (diseases of the alimentary tract, paranasal sinuses, diabetes mellitus, anaemia, and some other general disorders) Various allergic factors, such as dust, wool and hair of domestic animals, may become the cause of persistent blepharitis A prolonged exposure to chemical agents, such as aniline dyes and hair lacquer (in hair-dressers), and medicinal preparations (in pharmacy workers) may cause occupational chronic affections of the eyelids These are often concurrent with gen-

eral allergic disorders (dermatitides, vasomotor rhinitis, bronchial asthma) and an allergic factor can therefore be easily suspected as the cause of occupational blepharitis.

*Treatment* Efficiency of therapy depends on correct identification and removal of the cause of the disease. Sanation of the foci of chronic infection is required.

Measures aimed at general strengthening of the body, increasing its protective force, observation of the hygienic conditions for work associated with visual effort should be taken. Proper correction of abnormal refraction of the eye and adequate nutrition (sufficient amounts of vitamins) are necessary.

Microbial infection is listed among the various causes of exacerbation of chronic and persistent blepharitis. Anti-infectious therapy of a blepharitis patient should be reasoned because unsubstantiated use of medicinal preparations that will not improve the condition of the patient may, on the contrary, become the cause of additional irritation. In this connection, bearing in mind the resistance of pathogenic microflora to some widely used antibiotics and sulpha drugs, therapy should only be started after testing a given microflora for sensitivity to these preparations. Good results are obtained with a 10% solution of sulphamethoxypyridazine, 1% erythromycin ointment, etc. Many patients do not tolerate vehicles of ointments (especially patients with meibomian blepharitis caused by hypersecretion of the meibomian glands). This form of blepharitis should be treated by massage, defatting of the eyelid margins by ether, and application of a 1% brilliant green (before night sleep).

### ENTROPION AND ECTROPION

**Entropion.** This is the turning inward (inversion) of the eyelid margins toward the eyeball. Spastic and cicatricial entropion are distinguished. Spastic entropion often occurs in aged persons, while cicatricial entropion arises due to cicatricial contraction of the conjunctiva and the cartilage after [trachoma, diphtheria, burns, etc].

*Treatment* Entropion can sometimes be removed by eliminating the cause. If the entropion is slight, the eyelid is pulled from the eyeball by adhesive tape which easily attaches

to the eyelid margin and the skin of the cheek. If entropion is persistent, operative treatment is indicated

**Ectropion.** The margin of the eyelid separates from the eyeball and everts (to expose the conjunctiva in grave cases) The eversion is attended with constant lacrimation Incomplete closure of the eye slit, constant contact with air, dust, etc , irritates the cornea and, in grave cases, results in ulceration

Causes of ectropion are varied Spastic eversion occurs in some inflammatory diseases of the anterior eye Ectropion often develops due to infiltration and oedema of the conjunctiva the margin of the eyelid is separated from the eyeball while the orbicular muscle contracts to aggravate the outward turning of the eyelid

*Treatment* should be aimed at removal of the main disease Ectropion may be the result of paralysis of the facial nerve (decreased tone of the muscle causes the eyelid drop), of the muscle atrophy (senile ectropion), of cicatricial contraction of the skin after a burn, or eczema of the eyelid skin (cicatricial ectropion) These forms of ectropion are usually treated by operative surgery

## DISEASES OF THE LACRIMAL APPARATUS

Dysfunction of the lacrimal apparatus is normally characterized by lacrimation A collargol (colloid silver) test is commonly used in outpatient practice to locate the affected portion of the lacrimal ducts

The test is performed as follows a drop of a 2% colloid silver (collargol) is instilled into the conjunctival sac If the passage of the lacrimal ducts is unobstructed, collargol drains in five minutes (positive test) If the function of the lacrimal punctum or the lacrimal duct is disordered, collargol remains in the conjunctival sac for longer time (negative test)

Function of the lacrimal sac and ducts is tested by placing a cotton wool tampon into the nose (under the inferior concha) If the tampon is dyed by collargol in ten minutes after its instillation, the lacrimal sac and the lacrimal duct are considered unobstructed (positive test) If the tests are

negative, the patient should be examined by an oculist who will prescribe the necessary treatment

**Inflammation of the lacrimal sac (dacryocystitis).** The lacrimal ducts may be constricted and even completely contracted to stop the fluid outflow from the lacrimal sac which will increase the danger of its infection with microbial flora. Chronic inflammation of the lacrimal sac develops. It is attended with excessive lacrimation and pus may be expressed from the lacrimal sac. Constant presence of pus in the conjunctival sac causes inflammation of the mucosa (conjunctivitis) and any minor injury will cause development of purulent ulcer of the cornea.

Chronic dacryocystitis is *treated* surgically. An anastomosis is formed between the lacrimal sac and the nasal cavity (dacryocystorhinostomy).

Chronic process may be exacerbated into acute dacryocystitis. pronounced swelling develops in the region of the lacrimal sac. The swelling is painful to palpation, the skin becomes hyperaemic and oedematous. Body temperature often increases and headache develops.

**Treatment** Sulpha drugs are given per os or penicillin (250 000 U) is injected two times a day. Local application of heat (water-bag, UHF, quartz lamp) is helpful. A 10% solution of sulphamethoxypyridazine or a 20% solution of sulphacetamide should be instilled into the conjunctival sac 2-3 times a day. When acute inflammation subsides, the patient should be operated.

### *Review Questions*

- 22 Pus contained in the sty focus shall be expressed. Yes or no?
- 23 What form of blepharitis is severest  
(1) simple, (2) ulcerative, (3) squamous?
- 24 Collargol (colloid silver) is retained in the conjunctival sac for more than ten minutes. Shall the result of the test be considered (1) positive or (2) negative?

## Chapter 7

# Conjunctivitis

Diseases of the conjunctiva are the most frequently occurring pathology of the eye. They are the common cause of transient disability.

Commonly occurring inflammatory diseases of the eye mucosa are conjunctivites which make 30-50% of ophthalmological incidence. Aetiological factors of these diseases are quite varied. The following forms of conjunctivitis are differentiated:

- 1 Bacterial (a) purulent (the causative agents are staphylococcus aureus, pneumococcus, gonococcus, Koch-Weeks' bacillus, etc.), (b) non-purulent (causative agents Morax-Axenfeld diplococci, diphtheria bacillus, etc.)

- 2 Viral

- 3 Allergic

- 4 Conjunctivites caused by mechanical, chemical, or physical factors

- 5 Diseases of the conjunctiva caused by psittacosis, venereal lymphogranuloma and trachoma agents

- 6 Miscellaneous (unknown aetiology included)

According to their clinical course conjunctivites may be acute and chronic.

## BACTERIAL CONJUNCTIVITES

The proportion of viral and allergic conjunctivites has largely increased in recent years, but the share of bacterial conjunctivites in the ophthalmological incidence still remains high (about 33 per cent).

Table 3

## Differential Symptoms of Common Forms of Conjunctivites

Symptoms	Bacterial		Viral	Allergic
	Purulent	Non-purulent		
Exudate	Ample	Scant	None	Insignificant
Lacrimation	Moderate	Moderate	Ample	Moderate
Itching	Insignificant	None	None	Pronounced
Hyperaemia	Diffuse	Local	Diffuse	Diffuse
Preauricular lymph nodes	Normal		Often increased	Normal
Smear	Microbes	Microbes	Monocytes	Eosinophils
Fever	Rare	None	In separate cases	None

Despite certain differences, bacterial conjunctivites are characterized by common features. As a rule, they all begin with development of pathology in both eyes simultaneously. Or the second eye may become affected at a short lapse of time, measured by one or two days. The patient complains of pain in the eyes, excess lacrimation, the feeling of a foreign body in the eye (behind the upper eyelid), exudate is first mucous but soon becomes mucopurulent or purulent. The conjunctiva becomes hyperaemic. Due to dilation of superficial blood vessels the conjunctiva of the eyelids and the fornices becomes brick-red, swollen, and opacified, the shapes of the meibomian glands become indistinct, the oedematous fornix becomes protruded. Superficial capillary injection develops on the conjunctiva of the eyeball, it is more pronounced at the fornix and decreases toward the cornea.

Oedema of the eyeball conjunctiva may be so pronounced that the conjunctiva may rise in the form of a ridge round the cornea, its appearance becomes vitreous and yellow. The cornea may also sometimes be involved in the process (if the disease is not treated in due time). Grey dotted infiltrations are formed by the lower margin of the cornea. The disease is attended with photophobia and blepharospasm.



Aetiology of an acute conjunctivitis may be established by bacterioscopic analysis. To that end a smear should be taken by the nurse using a special loop, which is first held in the flame of a spirit burner. As soon as the loop cools down it is used to take a specimen of mucus from the superior and inferior conjunctival fornices. The specimen is applied in a thin layer to a slide glass, treated preliminarily with alcohol. The site is marked by a circle using a glass-writing pencil, and the slide is sent to the laboratory.

**Acute epidemic conjunctivitis.** This is caused by Koch-Weeks' bacillus and is a frequent disease in many hot countries. The source of infection is a diseased patient or a carrier. Infection is transmitted through the use of common domestic utensils (towels, door handles, etc.) with the absence of proper hygiene. Epidemic outbreaks are often at kindergartens, schools, etc.

The incubation period is very short from a few hours to 1-2 days. The specific symptoms are oedema of the inferior conjunctival fornix, minor haemorrhage under the conjunctiva, and purulent exudate. The disease is often attended with general weakness, elevated temperature, and headache. Complications on the part of the cornea (ulcers, infiltrations) may develop in grave cases.

**Treatment.** Instillation of a 20% solution of sulphacetamide at 2-3 hour intervals, 10% solution of sulphamethoxypyridazine on a polymer base, 2-3 times a day, applying ophthalmic insert (sulphamethoxypyridazine) to the conjunctiva, 1-2 times a day. Pus is removed from the conjunctival sac by irrigating with a 2% solution of boric acid and a mercuric oxycyanide solution (1 5 000-1 10 000).

**Gonoblennorrhoea.** A gram-negative diplococcus (Neisser's gonococcus) is the causative agent of the disease. Gonoblennorrhoea of newborns, children, and adults are distinguished. The disease develops in 1-2 days after infection. The eyelids become oedematous and indurated (the eyes are difficult to open). The conjunctiva is oedematous as well, it is sharply hyperaemic, and bleeds easily. In 3-4 days the eyelids become softer and ample pus (with a greenish hue) is liberated. The oedematous mucosa compresses the marginal sinuous vessels to impair the supply of nutrients to the cornea. The cornea may develop ulcers and perforations. The outcomes of the disease are grave. The cornea would be usu-

ally affected in adults in whom gonoblennorrhoea is normally grave.

*Treatment* Instillation of sulpha drugs, as described for epidemic acute conjunctivitis. Sulphamethoxypyridazine should be given per os (according to a special schedule), and penicillin should be injected intramuscularly (800 000 units a day)

*Prophylaxis of gonoblennorrhoea of neonates* As a foetus passes the birth canal of an infected mother, it may be infected with gonoblennorrhoea. To prevent the disease in a neonate, its eyes are wiped with cotton wool soaked in boric acid, and a drop of a 2% silver nitrate solution is instilled in each eye.

*Pneumococcal conjunctivitis.* It is caused by positive diplococcus (pneumococcus). Punctate haemorrhage on the scleral conjunctiva, along with oedema and purulent exudate, are characteristic signs of the disease.

*Treatment* is the same as in acute epidemic conjunctivitis. *Diphtherial conjunctivitis* Diphtherial inflammation of the conjunctival layer is caused by Loeffler bacillus. Occurs mainly in children. In typical cases the disease begins with oedema of the eyelids, which become so indurated that it is difficult to turn them out for inspection of the mucosa. In 2-3 days the eyelids soften and necrotized films can be seen on the eyelid mucosa. The affected sites will then heal to leave cicatrices that connect the mucosa of the eye and the lids. Ulceration of the cornea may develop in some grave cases. Light course of the disease ends in formation of soft films on the conjunctival cartilage. When the films are removed, the mucosa bleeds.

If diphtheria is suspected in a patient, he is given an injection of antidiphtheric serum (6 000-10 000 IU) before the results of the analysis are known, and directed to an infectious department.

*Conjunctivitis caused by Morax-Axenfeld diplococcus* tends to be chronic. Along with hyperaemia of the mucosa, it is characterized by reddening of the eyelids at the lateral and medial angles. The cornea is sometimes involved in the process.

*Treatment* Instillation of a 0.1-0.25-0.5% solution of zinc sulphate, 3-4 times a day.

## VIRAL CONJUNCTIVITIS

Adenoviral diseases of the eye occur in two forms as adenoviral conjunctivitis and epidemic keratoconjunctivitis.

The main causative agent<sup>1</sup> of adenoviral conjunctivitis is adenovirus of 3 and 7 serotypes. Epidemic keratoconjunctivitis is normally caused by adenovirus type 8. Local outbreaks of this disease are frequent at ophthalmological hospitals and other institutions. The infection spreads mostly through contact with infected medical tools and instruments, medicinal solutions, etc. The incubation period of adenoviral conjunctivitis is 4-8 days, and of epidemic keratoconjunctivitis, 10 days.

Adenoviral conjunctivitis begins as an acute process. The onset of the disease is usually preceded by (or concurrent with) affection of the upper airways (rhinitis, pharyngitis, etc.), or general manifestations of the disease such as elevated body temperature, headache, deranged sleep, less frequently dyspepsia.

Epidemic keratoconjunctivitis is in rare cases attended with affections of the upper airways or other general manifestations. Adenoviral infections are characterized by pronounced oedema of the eyelids and the conjunctiva which is often attended by a marked chemosis of the ocular conjunctiva. Exudation is not marked and pus is absent. The disease is as a rule associated with eruptions (small follicles) which are only superficial (predominantly in the inferior conjunctival fornix).

Regional adenopathy of preauricular lymph nodes frequently occurs. Epidemic keratoconjunctivitis is characterized by development (normally in 9-11 days) of subepithelial keratitis. A few small subepithelial infiltrations first develop (more frequently by the periphery). Their number then increases and in some cases they occupy the entire surface of the cornea. Larger infiltrations (the size of a coin) are less frequent.

*Treatment.* Adenoviruses are resistant to some generally used antibiotics and sulphur drugs. Interferon preparations having pronounced antiviral activity, and also tebrophen, fluorenal, pyrogenal and some other preparations are effective.

Leucocytic interferon (100 U/ml) is used for instillation, 6-8 times a day during the acute period of the disease

Tebrophen and fluorenal are given as ointment in the concentration of 0.1-0.25%, 3-5 times a day

Pyrogenal is used as eye drops, 5-8 times a day, depending on gravity of the disease

Corticosteroids (0.5% hydrocortisone suspension, 0.5% cortisone emulsion, 0.3% prednisolone solution) are given during reconvalescence only, their use should be avoided at the stage of fresh subepithelial infiltration or the preceding period

**Epidemic haemorrhagic conjunctivitis.** The disease was first reported in 1969 from Ghana. Numerous outbreaks of the disease were later reported from various countries of Africa, Asia, etc. The causative agent is attributed to the group of picornaviruses

Along with signs characteristic of adenovirus conjunctivitis a specific symptom is haemorrhage in the eyelid mucosa and the sclera, from punctate to diffuse haemorrhage that affects the entire eyeball. Haemorrhage resolves at various terms which depend on the size. Punctate haemorrhage normally resolves in 3-6 days, and large ones during two weeks

Unlike adenoviral conjunctivitis, the incubation period of epidemic haemorrhagic conjunctivitis is shorter, from 8 to 48 hours

*Treatment* In many respects it is the same as in adenoviral conjunctivitis. If the haemorrhagic component is pronounced (large haemorrhage under the conjunctiva or the eyelid skin) ascorutin is prescribed (1-2 tablets, t.d.s.)

**Herpetic conjunctivitis.** The aetiological agent is the virus of herpes simplex. Rarely occurs as an independent disease (mostly in children). More frequently it is attended with bullous eruptions on the skin of the eyelids, the wings of the nose, and the mucosa of the lips

Three forms are differentiated: follicular, catarrhal, and vesiculo-ulcerous

The follicular form resembles adenoviral affection of the conjunctiva, but differs from it by less pronounced inflammation, more persistent course, and tendency to relapses

The catarrhal form is characterized by a marked hyperaemia of the conjunctiva and short duration

The vesiculo-ulcerous form is characterized by bullous eruptions which open to give superficial ulcers. The ulcers heal without leaving cicatrices on the conjunctiva

*Treatment* Kerecid is instilled 6-8 times a day as an efficacious medicine to treat herpetic conjunctivitis

### ALLERGIC CONJUNCTIVITES

The incidence of allergic conjunctivites has markedly increased in recent years. This can be explained by a constantly growing number of factors (vaccination, administration of sera, chemical preparations, insecticides, etc.) that alter reactivity of the human body

In allergic conjunctivites, due to the presence in the conjunctiva of the lymphoid tissue and many blood vessels, the reaction may be immediate (which depends on the interaction of the allergen with the antibodies circulating in blood) and delayed (which depends on the sensitization of lymphocytes with the corresponding antigens)

The clinic of allergic conjunctivites is quite varied. Depending on aetiology it can be classified as follows: (1) infectious-allergic conjunctivites, (2) atopic conjunctivites (caused by pollen, medicines, foods and other allergens), (3) vernal catarrh

Along with general clinical examination methods, diagnosis of allergic conjunctivites employs the following specific techniques

1. Thorough allergological anamnesis. It is necessary to establish if conjunctivitis is associated with a certain season, if it occurs as a separate syndrome or in combination with vasomotor rhinitis, asthma, nettle rash, etc., if the reaction is general or local in the form of oedema, nettle rash after intake of some foods, to examine the labour conditions of the patient, occupational exposure to some harmful factors, the presence in the house of animals, fish in the aquarium, etc., it is also necessary to find out if any of the relatives is affected by allergic diseases, and some other circumstances.

2 Skin and provocative tests with bacteria, pollen, medicines, or other possible allergens.

### 3 Immunological methods

**Infectious-allergic conjunctivites.** These are characterized by increased reactivity of the delayed type Sensitization more often extends from a focus remote from the eye Other foci of chronic infections (tuberculosis, tonsillitis, cholecystitis, etc ) and also helminthiasis and mycoses can substantially change the reactivity of the body and cause diseases of the ocular mucosa (both separate diseases and combinations of diseases of the eyelids, cornea, and general allergic affections) Less frequently sensitization of the body depends on chronic infection of the mucosa (chronic conjunctivitis, meibomitis, canaliculitis, dacryocystitis, etc )

Infectious-allergic conjunctivites may occur at any season, and usually follow exacerbation of the infectious disease

**Phlyctenular keratoconjunctivitis.** This is a common form of infectious-allergic conjunctivitis, observed usually in children from 3 to 10, less frequently in adolescents The aetiological factor of the disease is mainly sensitization to tuberculosis mycobacteria It should be remembered that at the present period of tuberculous pathomorphism, the number of subclinical forms of primary tuberculosis has decreased Toxins or products of their decomposition spread from the focus and remain in the conjunctiva, where the conflict between the antigens and sensitized lymphoid elements occurs.

The clinical picture of phlyctenular keratoconjunctivitis (along with hyperaemia and infiltration of the mucosa) is characterized by development of one or several yellow-grey vesicles by the limbus These are surrounded by dilated vessels Patients with phlyctenular keratoconjunctivitis should be examined thoroughly by a phthisiotherapist, helminthiasis and other diseases should also be ruled out

**Treatment** Tuberculostatic preparations such as phthivazide, tubazide, etc , should be given (under control of a phthisiotherapist)

To ensure better tolerance, antibacterial preparations should be given together with vitamins of group B, and also ascorbic acid Calcium chloride should also be given a 10% solution one tablespoonful t d s , or a 0.25% solution intra-

muscularly (from 0.5 to 3 ml) or intravenously (5-10 ml of a 10% solution) in grave cases

Streptomycin sulphate drops (10 000 U/ml), 0.5% hydrocortisone ointment, 0.01% citral solution, riboflavin, mydriatics (scopolamine, atropine) are used topically

**Atopic conjunctivites.** Conjunctivitis associated with hay fever is the most characteristic representative of the group of allergic conjunctivites of the immediate type

**Hay fever conjunctivitis.** It is characterized by seasonal occurrence. The disease is exacerbated during blossoming of trees and grass. Both eyes are affected simultaneously. The patient complains of burning in the eyes, excess lacrimation, and photophobia. Marked hyperaemia of the conjunctiva with oedema and amplerous secretion are characteristic. The disease is attended by rhinitis.

*Treatment.* Specific desensitization with standard pollen allergens by consecutive subcutaneous administration of the allergen in the dose of 0.1, 0.2, 0.3 ml etc., to 0.9 ml daily or every other day, beginning with dilution  $1/10 \times 6$  with subsequent ten-fold strengthening of the concentration until whole allergen is finally administered.

The treatment is continued for 3-4 months and ends two months before blossoming begins.

**Conjunctivites caused by medicinal preparations and cosmetics.** Antibiotics, pilocarpine and other medicines often act as allergens. It should be noted that sometimes the vehicle of ointments or drops (rather than the active principle) may act as an allergen. Various cosmetics, such as nail varnish or ursol, can also cause allergic inflammation. Such conjunctivites are as a rule attended by eczema of the skin.

**Alimentary conjunctivites.** These often become manifested in 6-24 hours after eating a sensitizing food (egg, salt and pickled tomatoes and cucumbers, strawberries, etc.). Alimentary conjunctivites are characterized by familial susceptibility, recurrent dermatitides in childhood (diathesis), concurrent dermatitides on the body. Allergic Quincke's oedema often occurs.

**Vernal catarrh.** Conjunctival, corneal, and mixed forms of vernal catarrh are distinguished.

The conjunctival catarrh is characterized by milky conjunctival layer and large thick pale pink papillae (resembling

cobble-stone road) In cases with pronounced hypertrophy of the papillae, pannus is absent (in contrast to trachoma) and the papillae undergo back development under desensitizing treatment

The corneal form of vernal catarrh is characterized by development of pale grey vitreous thickenings of the limbus

Exudation from the conjunctival sac is either absent or it is insignificant (mucous filaments)

Vernal conjunctivitis persists for a year, with exacerbations in the spring and summer Allergic factors may play an important role in the genesis of this disease

*Treatment* Non-specific desensitizing therapy is recommended in exacerbations corticosteroids and antihistaminic preparations Histoglobulin is now widely used It is given subcutaneously in 2 ml for adults and 1 ml for children at three-day intervals (12-14 ml for a course for adults and 5 ml for children).

Conjunctivites caused by chemical, physical and mechanical factors An acute occupational disease, electric (flash) ophthalmia, often arises from insufficient protection of the eye from ultraviolet light of the welding arc (blast-furnace) Another variant of this disease is snow blindness (ophthalmia nivialis) It occurs in skiers, hikers, mountain climbers The disease begins in 5-6 hours after exposure to intense light and is manifested by strong photophobia, lacrimation, pain in the eyes and oedema of the eyelids These symptoms quickly subside (in a few hours).

*Treatment* Cold lotions, 0.5% tetracaine hydrochloride drops, 0.5% hydrocortisone and 0.01% citral solutions are recommended for instillation into the conjunctival sac

### INCLUSION BLENNORRHOEA (PARATRACHOMA)

This disease is caused by the same agent as psittacosis, lymphogranuloma and trachoma Sporadic cases of the disease among adults ageing from 20 to 40 are more frequent

The eyes are mostly infected directly from the urogenital tract Sporadic cases of blennorrhoea in neonates (infection in the birth tract of the woman) are less frequent

Local epidemic outbreaks are possible (contamination of



water in swimming pools, at children's institutions, by transmission of infection during tonometry, etc )

In some cases it is difficult to differentiate between inclusion blennorrhoea and adenoviral conjunctivitis

The incubation period of inclusion blennorrhoea is from 5 to 14 days One eye is affected more frequently, while bilateral processes occur in about 33 per cent of cases The eyelid conjunctiva and the conjunctival fornices become hyperaemic Exudate is first insignificant (mucopurulent) but as the process progresses, its amount increases significantly The exudate is characterized by the absence of microbial flora Regional preauricular adenopathy develops in 3-5 days Papillary hypertrophy is pronounced from the very first days of infection Follicles develop in two or three weeks of the disease The follicles then resolve but some of them may form thin soft scars that can only be viewed through a microscope About 50% patients develop vascularization during the acute period, which is attended with insignificant oedema and diffuse infiltration of the upper limbus Affection of the cornea is manifested as epithelial avascular keratitis

It should be emphasized that almost in all cases of sporadic infection it is concurrent with urogenital pathology (non-specific urethritis, endocervicitis, etc )

Decisive factors in differential diagnosis of inclusion blennorrhoea and adenoviral conjunctivitis are the results of cytological and microfluorescent studies

Cytoplasmic inclusions containing the causative agent at various stages of its growth are found in specimens of conjunctival or mucosal epithelium

Inclusion blennorrhoea in the subacute phase (in 2-3 months of the disease) should be differentiated from trachoma, the difference being in that only one eye is usually affected in inclusion blennorrhoea with the prevalent location of the process on the lower eyelid, adenopathy is present, while visible cicatrices and pannus are absent Data of epidemiological study might be decisive too

*Treatment* Local use of a 1% tetracycline, erythromycin or oletetrin ointment is recommended in stationary conditions (5 or 6 times a day) As the process begins subsiding (in the course of the first two weeks), antibiotics should be given

only 1-2 times a day (along with local use of corticosteroids such as cortisone, hydrocortisone, prednisolone)

In grave cases (paratrachoma attended by preauricular adenopathy and various general symptoms) local therapy should be combined with peroral use of antibiotics (tetracycline, erythromycin, oletetrin) or sulpha drugs (sulphadimidine, sulphamethoxypyridazine)

Tetracycline and nystatin are given in 100 000 U doses four times a day for 5-7 days, sulphadimidine in 0.5 g doses 4 times a day, also for 5-7 days. Sulphamethoxypyridazine is recommended in significant doses (1-2 g during the first day, and 0.5-1 g daily during the next five days).

#### TRACHOMA

This is a specific contagious keratoconjunctivitis characterized by chronic course attended with formation of follicles, papillary hyperplasia, pannus, and cicatrization. The source of infection is exudate from the conjunctiva of a patient. It is carried onto intact conjunctiva either by hands or from contaminated objects. The main route of infection spreading is close contact of infected and healthy people in the family, etc. The incubation period lasts for 5-14 days. The disease normally affects both eyes and the onset usually remains unnoticed by the patient. In rare cases the disease begins as an acute process. Four stages are distinguished in the clinical course of trachoma.

*The first stage* The symptoms become more pronounced, infiltration becomes diffuse (predominantly, infiltration of the superior conjunctival fornix and the cartilage), grey follicles are formed (their distribution is uneven), papillary hypertrophy develops along with affections of the cornea (pannus).

*The second stage* Intensified infiltration and development of follicles is accompanied by dystrophy of the follicles with development of cicatrices. The corneal affections become more pronounced.

*The third stage* Cicatrices are predominantly formed in the presence of follicles and conjunctival infiltration.

*The fourth stage* (inactive) Diffuse cicatrization of the affected mucosa in the absence of inflammation in the conjunctiva or the cornea.

**Pannus** (the specific affection of the cornea in trachoma) begins with the upper limbus. The infiltration and vascularization are then extended onto the superior sector of the cornea. In some cases, follicles are formed in the depth of the cornea near the upper limbus, which are then converted into round flat depressions.

**Complications of trachoma.** The cornea may be opacified significantly after grave trachoma. Rough scars may develop on the conjunctiva. This may be attended by impairment of vision. Rough cicatrization may cause distortion of the cartilage, ectropion of the eyelid, and also ingrowing eyelashes (trichiasis).

At the initial stage of the disease, trachoma is difficult to differentiate from folliculosis and follicular conjunctivitis. The former is characterized by formation of regular rows of small superficial follicles (containing clear fluid) on the intact conjunctival fornices of the eyelids (mostly the lower eyelid). The follicles resolve without leaving any cicatrices. Aetiology of folliculosis is unknown.

Follicular conjunctivitis may be of various aetiology (viral, allergic, etc.). Clinically this disease is manifested by formation on hyperaemic and indurated conjunctiva of large follicles (also arranged in regular rows and predominantly on the inferior conjunctival fornix).

**Treatment.** The method of treatment depends on clinical form and gravity of trachoma. In stationary conditions the patient is given locally 1% tetracycline, erythromycin or oletetrin ointment, 4-6 times a day.

Mild trachoma is treated in outpatient conditions by the same ointments (2-3 times a day) or instillation of a 10% solution of sulphamethoxypyridazine on a polymer base (1-2 times a day).

**Prophylaxis.** Trachoma has been eradicated in the Soviet Union. A constant epidemiological surveillance is very important for timely revealing of recurring and obliterated forms of trachoma.

### Care of Patients with Conjunctivites

The main aim of care of conjunctivitis patients is to preclude spreading of the infection. The patient should be

given his individual pipette, a separate bottle with the medicine, and other objects (pillows, towels, etc.)

Whenever a patient with adenoviral or epidemic haemorrhagic conjunctivitis is detected among other patients in an ophthalmological hospital, quarantine measures should immediately be taken to isolate the dangerous patient.

The medical nurse should obligatorily wash her hands before each ophthalmic manipulation. Patients with conjunctivitis are not recommended tonometry or physiotherapeutic procedures.

Wet cleaning of rooms using a 2% chloramine solution and decontamination of air by ultraviolet rays and adequate ventilation are very important.

Special diet is sometimes prescribed to patients with allergic conjunctivitis (to exclude food allergens). Synthetic fibre garments are not recommended to children with allergic conjunctivitis.

### *Review Questions*

25. Outbreaks of acute epidemic conjunctivitis caused by Koch-Weeks' bacilli more frequently occur in countries with (1) hot climate, (2) cold climate. Choose the correct answer.

26. A child with suspected diphtheric conjunctivitis should immediately be given anti-diphtheric serum. Yes or no?

27. Tonometry is contraindicated to patients with adenoviral conjunctivitis. Yes or no?

28. What stage of trachoma is characterized only by cicatricial changes in the mucosa of the eye (1) 1st stage, (2) 4th stage?

## Chapter 8

# Diseases of the Cornea and Sclera

Diseases of the cornea occur rather frequently. This, to a certain degree, depends on the fact that the cornea is the most prominent part of the eyeball.

Most common diseases of the cornea are its various inflammations, known as keratitis. Depending on the depth of the inflammatory focus, keratitis are divided into superficial and deep. Superficial keratitis occurs mainly through superficial injuries or as complication of other inflammatory diseases (conjunctivitis, dacryocystitis, etc.). The cause of deep keratitis would usually be endogenic factors (viral infections, tuberculosis, syphilis, disorders in trophic innervation, etc.).

**General symptoms.** Acute inflammation irritates the endings of the trigeminal nerve in the corneal epithelium and the patient develops photophobia, lacrimation, blepharospasm, and pain in the eye. Pericorneal injection of various intensity is also characteristic. This may vary from a pinkish crown to a dark violet wide band. The injection may be mixed if conjunctival hyperaemia attends the pericorneal injection.

Keratitis are also characterized by induration of the cornea which opacifies and deprives it of lustre. The infiltration is an accumulation of cells penetrating the cornea from the vessels. When viewed with lateral illumination, infiltration appears as an opacity with a grey, whitish-grey, or yellow-grey hue.

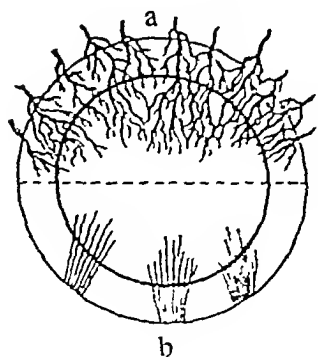


Fig 134 Vascularization of the cornea

a—superficial vessels,  
b—deep vessels

The infiltrations may vary in size, shapes, and depth of formation. The infiltration may be focal (in the form of small points, nodules, branches, etc.) or diffuse, to extend over a significant area, or to occupy the entire cornea. Vessels often grow into the cornea to reach the infiltration. Superficial vessels traverse the limbus from the conjunctiva and pass under the epithelium of the cornea. These are scarlet, branching, and anastomosing vessels. Deep vessels originating from the scleral vessels are found in deep keratitis. They are located in posterior layers of the cornea, are rectilinear, and resemble a brush (Fig. 134).

Infiltration often decomposes, epithelium is rejected, tissues are necrotized, and ulcers are formed. The ulcer is actually a defect of the corneal tissue with grey bottom and margins.

### ULCER OF THE CORNEA

A simple ulcer, however small it may be, may become purulent due to a secondary infection. The infected ulcer will be grave and may cause severe complications of the eye. As a simple ulcer turns into a purulent one, irritation of the eye increases significantly. The cornea round the ulcer becomes opaque, the fluid of the anterior chamber contains purulent exudate which precipitates in the form of a strip. Accumulation of pus in the anterior chamber is called hypopyon. The iris is as a rule inflamed. If the course of the ulcer is unfavourable and it penetrates deeper tissues, a very grave complication arises, perforation of the cornea.

The outcome of keratitis may be different. Small superficial infiltrations are resolved without any sequellae or leave only slight opacity. In deep keratitis, the infiltrate rearranges into connective tissue with formation of opacities that persist for life to become a vivid sign of the past disease. A perforated cornea heals to leave a scar (leukoma) which often becomes continuous with the iris. In very grave cases, the infection penetrates the interior of the eye to cause injuries to deeper membranes of the eyeball.

*Fluorescein test* Defects of the cornea epithelium are difficult to detect by simple inspection. Fluorescein staining of the cornea is used in these cases. One or two drops of a 0.5-

1% fluorescein solution are instilled into the conjunctival sac and the eye is then irrigated with water or physiological saline solution to wash off the stain. Fluorescein is removed from the intact cornea and remains to stain the affected sites where epithelium is injured. The defects become clearly visible as bright green spots against the background of intact cornea.

**Pneumococcal ulcer (creeping ulcer of the cornea)** Normally develops after injury of the cornea by small foreign bodies (in miners, agricultural workers, etc.) with subsequent infection by pneumococcus or other infectious agents. The depot of the pathogenic material is located in the lacrimal sac during its chronic inflammation. In a typical case, a greyish-yellow infiltrate develops in the centre of the cornea, the surface of the overlying cornea is punctured. The infiltrate soon decomposes to form a crescent-shaped defect one edge of which is rough and indurated (progressing margin). The other margin of the ulcer is clean, the bottom is covered with a greyish-yellow infiltrate. The destructive process creeps over the surface and spreads onto deeper structures, in the direction of the progressing margin. Involvement into the process of the iris and hypopyon are characteristic.

The process in the cornea is attended by oedema and spasm of the eyelid, lacrimation, photophobia, and decreased visual acuity.

Timely treatment of the ulcer stops the process, the purulent infiltration resolves and the cornea epithelizes to form opacity at the injured spot. In unfavourable cases the ulcer continues to propagate over the surface and into the depth of the cornea to cause perforations.

Prophylaxis of creeping ulcer consists in thorough removal of small foreign bodies from the cornea and in preventing infection of minutest defects in the cornea by local use of antibiotics or sulpha drugs (drops and ointments).

The lacrimal ducts should be examined. If purulent discharge from the lacrimal sac is revealed, the patient should urgently be operated in stationary conditions.

*Treatment* A 20% solution of sulphacetamide or a 10% solution of sulphamethoxypyridazine should be applied topically, penicillin and streptomycin should be given intramuscularly and tetracycline per os. To prevent formation of

synechiae, it is recommended to give mydriatics (1% atropine and 0.25% scopolamine solutions). Cryotherapy is also given. Urgent surgery is indicated in the presence of purulent dacryocystitis (dacryocystorhinostomy).

**Corneal ulcer caused by pyocyanic bacillus.** A specific feature of this infection is rapid propagation of the destructive process in depth so that the cornea may be perforated in two days. Urgent treatment is therefore required. Polymyxin (100 000 U/ml) should be applied locally at hour intervals, this antibiotic should also be given subconjunctivally (0.3 ml).

**Fungous ulcer of the cornea.** The increasing incidence of the fungous ulcer of the cornea is now associated with prolonged use of antibiotics and corticosteroids. The affection is characterized by the presence of a demarcating ridge consisting of decomposing corneal tissue round the focus of opacity in the centre of the cornea. The course of the disease is persistent.

*Treatment* Nystatin (or amphotericin) drops are instilled 6-8 times a day.

**Corneal ulcers due to vitamin A deficiency.** These occur in children. The disease begins with development of dryness of the conjunctiva, which then extends over the entire cornea. The cornea becomes opaque, infiltration develops in the centre, the cornea softens (keratomalacia) and necrotizes.

*Treatment* The general condition of the child should be improved by adequate nutrition (cod-liver oil, vitamin A).

**Marginal ulcer of the cornea.** The aetiology is mostly allergic. The course is favourable. Corticosteroids are efficacious.

### HERPETIC KERATITES

Herpes is the most widely spread infection of man. It persists in the body for lengthy periods of time (mostly in the latent form).

Primary and recurrent herpes are distinguished. Primary infection occurs till the age of five. Children with primary infection may develop keratoconjunctivitis along with other affections of the body.

A characteristic feature of primary herpetic keratitis in children is early and intense vascularization of the cornea.



The virus of herpes simplex remains in the human body in the latent state and may then manifest by recurrent attacks of the disease affecting various organs. Primary herpes is in most cases symptomless. Herpetic infection of the eye is more often manifested by inflammation of the cornea.

Various factors may activate the disease and promote its relapses in the eye: fever, emotional stress, chills, etc. The common signs of herpetic keratitis are as follows:

- marked seasonal variation (connection with seasonal infections such as influenza, chills, etc.),

- prolonged and flaccid course, tendency to recurrence,

- neurotrophic character of affection with decreased sensitivity of the cornea,

- inadequate vascularization of the cornea and slow regeneration of the ulcerating foci,

- mostly unilateral affections

Superficial herpetic keratitis (dendritic, punctate, stellate) and deep keratitis (disk-shaped and herpetic corneal ulcer, keratouveitis) are distinguished.

Dendritic keratitis is the most specific form of the disease, pathognomonic of herpes alone. Infiltrations develop in the epithelial layer of the cornea along the route of the nerve trunks. They fuse and ulcerate to form an intricate pattern resembling a branching tree which becomes clearly seen after staining with a 1% fluorescein solution (Plate 10).

Deep keratitis are characterized by spreading of the infiltration into the stroma of the cornea. The disease is usually attended with a more or less pronounced affection of the vessels.

Disk-shaped keratitis (keratitis disciformis) is pathognomonic of a herpetic process although in some cases it may be caused by other agents (virus of herpes zoster, adenoviruses, etc.).

The clinical picture is characterized by the presence of a deep rounded infiltrate in the central optic zone of the cornea. The infiltration readily resolves under appropriate therapy.

Herpetic ulcer of the cornea is a very flaccid and persistent disease. It often develops in patients treated earlier with corticosteroids (topically). The ulcer is normally not purulent but it can be complicated with secondary infection. In its

prolonged course and in the presence of descemetocoele (strong thinning and protrusion of Descemet's membrane and the endothelium in the form of a vesicle) the disease requires surgical treatment, consisting in transplantation (layer by layer) of the cornea

Herpetic keratouveitis is the disease of the cornea with marked changes in the vascular system

*Treatment.* An antiviral preparation (interferon, oxolin, fluorenal, and other ointments) is indicated in the acute stage of herpetic keratitis. Kerecid (0.1% solution) is indicated as drops (6-8 times a day) or as a 0.5% stoxil ointment (3-5 times a day). Interferon (150-200 U) is instilled in the affected eye 6-8 times a day. Oxolin, fluorenal and tebrophen ointments are given 2-3 times a day (0.1-0.25% concentration)

Mydriatics (a 1% atropine sulphate solution, 0.2% scopolamine solution) are given together with the antiviral preparations (1-2 times a day)

If the process is grave, protracted and attended by trophic disorders, vitamins B<sub>1</sub>, B<sub>6</sub> and others should be given intramuscularly. Electrophoresis with procaine hydrochloride should be used in the presence of pains. Diathermocoagulation and coagulation with a laser beam are used in superficial herpetic keratitis

### DEEP INTERSTITIAL KERATITES

These are characterized by focal or diffuse infiltration of the cornea without ulceration. The diseases are associated with congenital syphilis, tuberculosis, malaria, brucellosis, and other infections. Immune factors are also important in the mechanism of development of these diseases

Keratitis associated with congenital syphilis develops at the age of 5 to 20, first in one eye and then (within a relatively short time) in the other eye. The main clinical signs are oedema, lymphatic infiltration, deep vascularization of the corneal stroma, and contraction of the pupil. The patient complains of photophobia, pain, and impairment of the visual power. Other signs of congenital syphilis are seen as well. The so-called Hutchinson triad (the combination of diffuse interstitial keratitis, labyrinthine disease, and Hutchinson

teeth) occurs especially frequently. Sabre shin, saddle nose, and other signs are typical of inherited syphilis. Wassermann's reaction is usually positive. The disease is persistent. In some cases it is complicated by iritis with formation of commissures by the margin of the pupil and secondary glaucoma. As a result the cornea becomes hazy and vision is impaired. Blindness may occur finally due to atrophy of the optic nerve.

*Treatment* General treatment as in syphilis, carried out by a venercologist, is of little effect in the eye diseases and patients should therefore be treated at ophthalmological hospitals.

Local use of corticosteroids, riboflavin drops, etc., are recommended along with hot water bags, sollux, UHF waves, counter-attractive therapy (leeches, hot feet bath).

### DEGENERATIVE CHANGES IN THE CORNEA

**Keratoconus.** First symptoms such as dimmed vision and impaired acuity would normally develop at the age of 10 to 20. Thinning and protrusion (in the form of a cone) of the central portion of the cornea in the absence of inflammation are another sign. The disease is associated with genetic factors. When the process progresses, perforation of the cornea may occur.

*Treatment* Contact lenses are recommended at the early stage of the disease. When the danger of perforation arises, operative intervention (transplantation of the cornea) is indicated.

**Dystrophic keratoleukoma.** The disease is characterized by opacity of the cornea and differs from opacity in keratitis by that the latter is attended by pericorneal or mixed injection. The manifestations are varied in form.

**Nodular keratoleukoma** develops in the early age to affect both eyes. The disease persists for life and is often familial.

**Epithelial-endothelial dystrophy (Fuchs' dystrophy).** The cornea is affected at the age of 30 to 40. The process is slow. The patient complains of dimmed vision (due to hyalin deposition in Descemet's membrane), oedema, and vesicular affections of the endothelium and epithelium.

*Treatment* A course of vitamin B<sub>1</sub> injections, tissue therapy (aloe, Fibs), riboflavin drops and a 0.01% citral solution are recommended (topically)

**Arcus senilis.** A white ring around the margin of the cornea is formed in aged persons. It is separated from the limbus by a narrow ring of clear cornea.

The cause of opacity is lipid degeneration of the superficial layers of the cornea.

*Treatment* none

### DISEASES OF THE SCLERA

Diseases of the sclera are usually inflammatory.

**Episcleritis** is the inflammation of the upper layers of the sclera. It is manifested by focal or diffuse bluish or violet thickening of episcleral tissue. Nodular thickening is less frequent. Moderate pain in the eye and photophobia are characteristic signs. The disease is chronic, relapses are not infrequent.

**Scleritis** is the inflammation of deep layers of the sclera. It is attended with strong pains and is often complicated by diseases of the cornea (keratoscleritis). Inflammation of the iris (keratoiridoscleritis) is also possible. The sclera thins and bulges (staphyloma).

The disease is associated with tuberculosis, rheumatism, influenza, and other factors.

*Treatment* A 0.5% hydrocortisone (2-3 times a day) and dry heat are given topically. General treatment depends on the aetiology of the disease.

### Review Questions

29. How does the destructive process propagate in the ulcer of the cornea caused by the pyocyanic bacillus?
  - (1) over the surface of the cornea, or
  - (2) inside the deep parts of the cornea?
30. Does the sensitivity of the cornea change in herpetic keratitis?
31. Keratoleukoma persists for a long time after deep keratitis. Yes or no?

## Chapter 9

### Diseases of the Lens and the Uvea

The most common diseases of the vascular layer, uveites, are mostly endogenic by their aetiology. Many infectious diseases such as influenza, tuberculosis, toxoplasmosis, brucellosis, etc. may metastasize into the vascular layer of the eye to cause its inflammation.

Injuries or ulcer of the cornea may extend onto the iris and the ciliary body by transmission of the infection or toxins through exogenic routes.

Allergic factors are also important in pathogenesis of uveites. These factors are favoured by chronic infections in the body, especially streptococcal infections in tonsillitis, rheumatic arthritis, etc.

Focal (granulomatous) and diffuse (non-granulomatous, toxico-allergic) uveites are differentiated. Depending on localization in the vascular system, uveites are also differentiated into iridocyclitis, or anterior uveitis (inflammation of the iris and the ciliary body) and choroiditis, or posterior uveitis (inflammation of the choroid). The retina is often involved, and the process is then called chorioretinitis. Pan-uveitis is the inflammation of the entire vascular layer of the eye. It develops due to anastomosing of long and short posterior ciliary arteries.

**Iridocyclitis.** The disease begins by acute symptoms. Strong pain develops in the eye but it soon radiates to the corresponding portion of the head. The patient complains of photophobia and unclear vision.

#### MAIN CLINICAL SIGNS OF IRIDOCYCLITIS

1 *Pericorneal injection.* Its degree varies. In grave cases, redness around the cornea may have a violet hue, and is associated with dilatation of the conjunctival vessels (mixed injection).

2 *Change in the pattern and colour of the iris.* Dilatation of the vessels in the iris changes its colour, the blue iris ac-

quiring a greenish hue, while the dark brown iris reddens. Strong exudation alters the pattern of the iris.

These changes are characteristic of the most diffuse iridocyclitis. Focal iridocyclitis (tuberculous, syphilitic and other aetiology) is characterized by nodular thickening (tubercles, papules, gummas) on the iris surface.

3 *Changes in the pupil configuration* The presence of exudate favours adhesion of the iris to the lens (posterior synechia) which distorts the shape of the pupil.

4 *Changes in clearness of the fluid in the anterior chamber and precipitation on the posterior surface of the cornea* The contents of the anterior chamber is opacified by exudate which subsequently precipitates to the bottom. The exudate may be serous, fibrinous, and less frequently purulent (hypopyon). The iris vessels may bleed hence precipitation of blood on the bottom of the anterior chamber. Accumulation of blood in the chamber is known as hyphema.

The products of ciliary cell activity are specific grey punctate precipitates on the posterior surface of the cornea. They are mostly located in the lower sector of the cornea (in the form of a triangle). Precipitates are mainly composed of fused lymphocytes and pigment grains from decomposed cells of the pigment epithelium of the ciliary body and the iris.

### COMPLICATIONS OF IRIDOCYCLITES

1 *Secondary glaucoma* Synechia and exudate deposits may interfere with normal circulation of the intraocular fluids and increase intraocular pressure.

2 *Complicated cataract* Flaccid iridocyclitis may sometimes be attended by opacity of the lens, first in its posterior cortical layers and then in the entire lens.

3 *Opacity of the vitreous body and detachment of the retina* Opacity of the vitreous body may be diffuse or in the form of flakes and filaments. The retina may be detached due to commissures. All these changes may impair visual function and even cause atrophy of the eye. Hence the importance of correct diagnosis and timely treatment.

The early stage of iridocyclitis is sometimes overlooked or mistaken for conjunctivitis. It should be remembered that conjunctivitis does not affect the visual acuity, while pains,

photophobia and injection of the ciliary vessels, characteristic of iridocyclitis, are absent in conjunctivitis.

Acute iridocyclitis attended by strong pain and opacity of the eye fluids may be mistaken for acute glaucoma. Special attention should therefore be paid to the intraocular pressure (increased in glaucoma) and to the pupil (dilated in glaucoma).

*Treatment* The pupil should in the first instance be dilated and maintained in this condition. A 1% atropine or its combination with other mydriatics should be instilled 3-4 times a day (depending on efficiency).

Corticosteroids, such as cortisone, prednisolone, etc., should be used in grave cases topically as anti-inflammatory preparations (subconjunctivally). Dimedrol, butadion, and sulphia drugs should be given per os. Specific treatment is indicated in granulomatous (tuberculous, syphilitic, etc.) iridocyclites.

Warm compresses (for ten minutes 3-4 times a day), collyx, and analgesics (amidopyrine, analgin) should be given in cases with pain.

If intraocular pressure increases (secondary glaucoma) diacarb is given per os 1-2 times a day.

**Choroiditis.** Isolated affection of the choroid is characterized by the absence of pain due to the absence of sensitive nerves in the choroid. Disordered vision is characterized by the appearance of sparks and flashes (photopsia), distorted image of objects (metamorphopsia), and decreased acuity of vision. Choroiditis may only be diagnosed by ophthalmoscopy. Limited yellowish-white or greyish foci, slightly protruding toward the vitreous body, can be revealed in various regions of the eye bottom. The retina over the focus is slightly turbid. The focus will later be resolved or replaced by connective tissue, the choroid will be atrophied to expose the sclera, the foci turn whitish, sometimes encircled in a pigmented ring. The visual function is impaired depending on the location of the focus.

A diffuse process in the choroid is characterized by the presence of diffuse whitish-yellow fields occupying almost the entire surface of the choroid.

**Endophthalmitis.** This is a purulent inflammation of the

inner membranes of the eye. It arises due to exogenic factors, mostly in perforated wounds of the eye. Endogenic factors may also become the cause of the disease. The process is then known as metastatic ophthalmia. It is usually associated with sepsis (especially puerperal sepsis), pneumonia, cerebrospinal meningitis, etc.

The power of vision strongly deteriorates in this disease and the patient feels strong pains in the eye. The body temperature increases, asthenia develops, the patient sometimes vomits. The eyelids are oedematous, exophthalmos varies in its degree, the cornea is indurated. A yellow purulent exudate is seen through the pupil (abscess of the vitreous body). When the process extends to the outer membranes, panophthalmitis (purulent inflammation of all the structures of the eye) develops to cause, in some cases, a complete loss of the eye. The prognosis is always grave. The patient should urgently be hospitalized. The complex therapy includes sulphadiazine (per os) and antibiotics (intramuscularly and topically). If this fails, operative treatment is indicated.

The main change in the lens is the loss of its transparency. Opacity of the lens is known as cataract. In most cases cataract is attended by impaired vision, the degree of which depends on location of the focus of opacity and its intensity. If the entire lens is involved, the visual power drops sharply but the eye retains correct perception of light.

Congenital and acquired cataracts are differentiated. Congenital cataract is often concurrent with other inherited changes in the eye, such as microphthalmia and aniridia. The genesis of these cataracts is to a considerable degree connected with intrauterine diseases, viral infections, in particular. Congenital cataracts are as a rule persistent. The presence in a child of congenital lamellar or complete cataract may be combined with strabismus and nystagmus.

Operative intervention in lamellar and complete cataract is recommended in early age (from 1 to 2).

Acquired cataracts progress with age. By aetiology they are divided into (1) senile, (2) complicated (associated with diseases of the eye proper), (3) cataracts associated with mechanical and chemical injuries of the eye lens, (4) stellate (cortical), and (5) cataracts associated with systemic diseases such as diabetes, tetanus, etc.



Senile cataracts occur most frequently. These develop in aged persons (over 50). Depending on the degree, cataracts are classified as primary, immature, mature and hypermature (overripe).

Primary cataract is characterized by opacity in the form of needles under the capsule in the anterior and posterior cortical layers of the lens. When viewed in the passing light, they show as black needles against the red background of the pupil.

When the process progresses, the primary cataract enters its next stage, immature cataract. This is characterized by increasing opacity, its foci fuse to cover the entire surface of the pupil. Anterior cortical layers of the lens still remain clear.

Mature cataract is characterized by opacity of all cortical layers (up to the anterior capsule of the lens). The patient is unable to view objects.

The lens sometimes increases in size during immature or mature cataract (swelling cataract). The anterior chamber diminishes in size and the intraocular pressure increases. Operation is indicated. The nurse should see to it that the patient with cataract be under constant observation of the oculist, and his intraocular pressure be regularly measured.

Overripe cataract is characterized by the following changes: (1) the lens diminishes in size and shrinks, opaque cortical masses become dense and cholesterol and lime are deposited in the capsule of the lens, (2) the cortical substance of the lens thins to a milk-like fluid and the denser nucleus of the lens sinks by gravity.

*Treatment.* Vitamins, instillation of vicia in three times a day are indicated in the early stage of cataract. Extraction of the cataract is indicated in mature stage. The operation is indicated if the loss of visual power in both eyes is significant (below 0.1), and in immature cataract.

### Care of Patients After Extraction of Cataract

In past times (before corneoscleral sutures were successfully used) the postoperative period continued for a long time. The patient had to keep bed for four days to ensure adequate adaptation of the margins of the operative wound (to pre-

vent postoperative complications) During the first day post-operative the patient would have a binocle bandage During the second and third days the bandage was renewed, the patient's head was half elevated (half-sitted position), and one eye was relieved on the bandage On the fourth day the patient was allowed to leave his bed (to go to a lavatory)

At the present time, with the incorporation of corneoscleral sutures in surgical practice, the situation has changed significantly If 10-12 sutures are placed, the patient is allowed to leave his bed and walk on the day of the operation If only one suture is placed, the patient should keep bed for one day

*Diet* Tea is given on the day of the operation, and a small amount of broth in the evening On the next and other days the patient is given milk and vegetables (hard food should be avoided) Complications may arise during the postoperative period emptying of the anterior chamber, bleeding in the anterior chamber, etc In the former case a binocle bandage should be placed for 24 hours, and the patient is placed in bed If hyphema develops, the bandage is binocle and the patient is given rutin, vikasol (1 tablet two times a day)

### *Review Questions*

- 32 What factors are responsible for development of uveites (1) exogenic or (2) endogenic?
- 33 Visual acuity is impaired in iridocyclitis yes or no?
- 34 What food should be given to a patient on the first day after extraction of cataract
  - (1) liquid tea and broth,
  - (2) solid cheese, sausages?

## Chapter 10

### Diseases of the Retina and the Optic Nerve

Ophthalmoscopic examination is important in diagnosis of diseases of the retina. Affections of the retina are manifested as changes in the vessels, bleeding in various layers of the retina, opacity of otherwise clear retina (diffuse or focal), pigmentation of the retina, detachment and rupture of the retina.

Acute obstruction of the central artery and thrombosis of the central vein of the retina should in the first instance be mentioned among vascular disorders of the retina. These may drastically impair blood circulation and cause considerable impairment of visual power.

**Obstruction of the central retinal artery** may be associated with a closure of the artery lumen by an embolus (carried from the cardiac valves), thrombus (due to endarteritis and sclerotic changes, mostly in the aged) and a spasm of the artery. All these affections are attended by the loss of vision (to complete blindness) in one eye. Visual acuity may be regained after a transient spasm of the artery.

The ophthalmoscopic picture of the eye bottom is characterized by a significant constriction of the arteries. The retina around the optic disc and in the region of the yellow spot is opaque white with a dark red spot (due to luminescence of the choroid in the region of the central fovea of the yellow spot) (Plate 11).

*Treatment* should be begun as early as possible. Spasmolytics and vasodilatory preparations such as nitroglycerol (2 drops of a 1% solution on the tongue, or a 0.001 g tablet under the tongue, or else inhalation of amyl nitrite, 2-3 drops on cotton wool) should be given in the first instance. Nicotinic acid (0.05-0.1 g) should be given per os.

**Thrombosis of the central retinal vein.** The most common

cause of this disease is atherosclerosis and hypertension in the aged. Obstruction of the central vein is attended with a sharp deterioration of vision. The picture of the eye bottom is quite characteristic: the optic disc is oedematous, its boundaries are indistinct, the veins are dilated, sinuous, and bleeding.

*Treatment* Assistance of an internist or a neuropathologist is often required for the main disease (hypertension, atherosclerosis). Anticoagulants (heparin, phenylin, pelentan, etc.) should be given along with other medicinal preparations. The prothrombin index should always be taken into account: it should not be lower than 60% during the entire time of anticoagulant therapy. Antispasmodic and antisclerotic preparations should also be given.

**Changes in the retina in hypertonic patients.** Changes in the retina and its vessels are indicative of various hypertonic phases. The initial phase is mainly marked by spasmodic changes in the retinal vessels (constriction, sinuosity of minutest veins in the region of the yellow spot). If essential hypertension is marked, the arterial walls are thickened due to sclerotic changes, the vessels are drained of blood, the veins become impressed at the point of crossing with the arteries, and minor haemorrhages occur.

Grave disease is marked (along with above listed signs) by appearance in the retina of white foci of variable shapes and by vast haemorrhages. Stellate affection is formed in the centre of the retina which means dystrophy of its elements.

**Diabetic retinopathy.** This is characterized by haemorrhage, mainly in the region of the yellow body and around the optic disc. White foci are less frequent. Diabetic retinopathy usually occurs in patients suffering from diabetes for considerable periods of time (8-10 years).

**Retinal pigment dystrophy.** The disease depends on the genetic factors, and develops at the age of 6 to 14. The pathological process involves the rod cells of the retina in both eyes and is characterized by replacement of destroyed nerve cells of the retina by pigment epithelium cells and by sclerosis of the vessels and gradual atrophy of the optic disc. The first symptoms of the disease are impaired vision and orientation in space in dim light and in dusk (night blindness). The peripheral visual field narrows, while the central vision remains unchanged for a long time.

*Treatment* of slight effect.

**Detachment of the retina.** Visual disorders associated with detachment of the retina are manifested in narrowing of the

visual field (on the side opposite to detached retina) and a sudden and significant loss of the central vision. Complete detachment is followed by blindness.

The most frequent cause of retinal detachment is its rupture or separation from the point of attachment accounting for the penetration of the liquid fraction of the vitreous body into the space between the retina and the choroid. Retinal dystrophy and changes in the vitreous body are among other important factors. An eye injury is a frequent cause of the rupture. Retinal detachment is viewed in an ophthalmoscope as a grey dome (Plate 12).

*Treatment* of the retinal detachment is surgical.

**Postoperative care.** The patient should keep bed for 5-7 days. During the first hours after the operation, the lips of the patient should be wetted with a moist tampon (the patient feels thirsty during this period). A few teaspoonfuls of boiled water may be given to the patient in the evening. The nurse should see to it that the patient's head be immobilized correctly. Rolled bed-sheets should be placed on both sides of the head. The patient may take some food on the next day: warm tea, wheat bread, butter, porridge. Easily assimilable food (milk and vegetables) may be given during next days. A cleansing enema should be given on the third day postoperative. Bed linen should be changed if necessary. The nurse needs an assistant to perform this operation. The patient embraces the nurse by her neck to lift himself from the bed. Meanwhile an assistant removes the bed sheet from under the patient (down to his waste). The patient returns carefully to his former position and the assistant removes the rest of the sheet from under the patient's legs. A new sheet is laid in the reverse order: the nurse helps the patient lift his pelvis and then the legs.

**Retinoblastoma.** This is a tumour arising from the retinal germ cells. Occurs mainly in infants. A developed stage of the disease is characterized by a yellowish-white luminescence of the pupil. A yellowish-white mass of the tumour can be seen in the interior of the eye. Retinal vessels and sometimes haemorrhage may be seen on the tumour surface.

*Treatment.* If the process is unilateral, enucleation of the eyeball is indicated with subsequent radiotherapy. If both

eyes are affected, one of them should be spared (radio- and chemotherapy of the remaining eye)

Diseases of the optic nerve may be inflammatory, congestive or dystrophic, and attended by dysfunction of the central and peripheral vision, limited field of vision with respect to colour perception and decreased twilight vision

**Inflammation of the optic nerve (neuritis).** Infectious diseases, such as influenza, malaria, typhus, arachnoiditis, basilar meningitis, etc., are common causes of neuritis of the optic nerve. The patient complains of rapid impairment of vision. Inflammation of the optic disc may vary in its degree. Ophthalmoscopy reveals reddening of the optic disc, its indistinct boundaries, dilation and sinuosity of the veins. Haemorrhages (in the form of lines) may occur by the periphery of the disk.

**Retrobulbar neuritis.** The process is localized in the trunk of the optic nerve, i.e. behind the eyeball. Retrobulbar neuritis is characterized by the absence of changes in the eye bottom, or these may be insignificant in the form of slight indistinctness of the optic disc boundaries and insignificant dilation of the veins. The visual power decreases, and the boundaries of the visual field narrow (with respect to colour perception), a central scotoma is characteristic.

Multiple sclerosis, various infections, intoxications, etc., may be the aetiological factors of this neuritis.

*Treatment* depends on the aetiology of the process. Antibiotics and sulpha drugs are indicated. In order to improve trophics, vasodilating preparations (nicotinic acid, papaverine, per os) and vitamins ( $B_1$  and  $B_{12}$ , injections) are given.

**Engorged papilla** is a symptom of increased intracranial pressure due to various causes such as tumour of the brain, gumma, cysticercus, meningitis, local pathological processes in the orbit due to compression of the central vein, etc.

In contrast to neuritis, engorged papilla is characterized by preservation of high acuity of vision for a considerable period of time. The patient may complain of headache. Ophthalmoscopy may reveal (in typical cases) an enlarged optic disc located over the retina and significant dilation of the veins (as if ascending the disc).

*Treatment* depends on the aetiology of the disease. If a newgrowth in the cranium is detected, the treatment is

performed by a neurosurgeon. Assistance of a neuropathologist is required in cases with meningitic aetiology

**Atrophy of the optic nerve.** Primary and secondary atrophy of the optic nerve are distinguished. The latter results from neuritis or engorged papilla of the optic nerve.

Simple or primary atrophy of the optic nerve may arise as a result of retrobulbar neuritis in atherosclerotic changes in the vessels, in methyl alcohol poisoning, syphilis of the brain, multiple sclerosis, injury of the optic nerve, and other processes.

Ophthalmoscopy reveals a white disc and constricted vessels.

Prognosis is frequently unfavourable. As the process is progressing, the visual field narrows, the power of vision decreases, and blindness may occur.

*Treatment* depends on the aetiology of the affection. Injections of a 1% nicotinic acid (1 ml daily, for a course of 20 days) and of vitamin B<sub>1</sub>, tissue therapy, etc., are indicated to improve blood circulation and to stimulate the remaining nerve cells.

### *Review Questions*

- 35 What medicines should be prescribed in the first instance to treat acute obstruction of the central retinal artery (1) spasmolytics, (2) vitamins?
- 36 Shall the lips of the patient operated for detachment of the retina be wetted with a moist tampon?
- 37 How shall the bed linen be changed in the bed of a patient operated for detachment of the retina (1) by the patient himself, (2) by a nurse and an assistant?

## Chapter 11

# Glaucoma

The name glaucoma originates from the Greek *glaukos*, blue-green, since it has been long noticed by the ancients that if the colour of the eye resembles that of sea water, the eye will be affected by blindness.

Glaucoma is a grave disease which affects mostly the aged (over 40), glaucoma of the young occurs rarely. It is characterized by the following main symptoms: permanent or transient elevation of the intraocular pressure, typical defects of the visual field, and atrophy of the optic disc.

The outer membranes of the eyeball (sclera, cornea) form a closed space whose contents are the inner membranes (especially the ciliary body with the appendages) with a developed system of blood vessels. They produce moisture which normally fills the anterior and posterior chamber. The liquid is drained through the angular portion of the anterior chamber and the surrounding structures. The pressure which the fluid exerts on the eye walls is known as the intraocular pressure. It characterizes the strain or the tone of the eye. The intraocular pressure depends on some variables such as elasticity of the eyeball walls and the amount of the fluids inside the eye, which in turn depends on the blood supply to the intraocular vessels, the secretion of the fluid and its drainage, and also on metabolic and other processes. The normal range of intraocular pressure varies in people from 18 to 26 mm Hg. But the intraocular pressure does not remain constant in one person: the circadian variations range from 2 to 4 mm Hg. The pressure increases in a glaucoma patient, and the range within which this pressure varies during the day increases as well.

The given values of the intraocular pressure in man are slightly exaggerated by tonometry, while true pressure can only be determined on experimental animals with destruc-



tion of the eye. The intraocular pressure is assessed indirectly, by exerting pressure on the eye: the higher the intraocular pressure, the stronger its resistance to the pressing effort. This principle underlies the measurement of the intraocular pressure by a Maklakov apparatus consisting of a hollow metal cylinder weighing 10 g closed on both ends with a milky glass.

Tonometry with this apparatus comprises the following operations. The patient is placed on his back and a 0.5% dicaine solution is instilled in the conjunctival sac of the eye to anaesthetize the cornea. The cylinder ends are stained with a thin layer of paint and the patient is asked to look in front of him and fix his eye at the end of the forefinger (in 3-5 minutes after instillation of dicaine). The tonometer is placed on the central part of the cornea. The loop of the tonometer handle is lowered to the middle of the cylinder which is now allowed to rest with its weight on the cornea and to flatten it. The loop is then raised to the initial position and the tonometer is removed. The stain of the bearing end of the tonometer cylinder remains on the cornea at the place where it had contact with it. The intraocular pressure is determined by the diameter of the imprint, which in turn is first transferred from the eye onto a piece of clean paper slightly wetted with alcohol. Using a special ruler (B. L. Polyak) the paper imprint is measured and intraocular pressure determined.

### CLINICAL SIGNS OF GLAUCOMA

Primary, secondary and congenital glaucomas are distinguished. Congenital glaucoma is associated with underdeveloped or abnormally developed angle of the anterior chamber. **Hydrophthalmos.** The disease occurs in infants. The eyeball increases, the sclera and the cornea are distended. Underlying tissues can be easily seen through the thinned sclera. Increased intraocular pressure causes atrophy of the retinal nerves and the optic nerve, hence blindness.

*Treatment* operative (goniotomy and other operations).

Another form of infantile (juvenile) glaucoma may have the same symptoms as in adults. The disease occurs less frequently and often causes blindness in childhood.

Secondary glaucoma is associated with another disease, i.e. increased intraocular pressure is the effect of a known cause.

Secondary glaucoma may arise after an injury of the eye, thrombosis of the central retinal vein, uveitis, etc.

The primary form of the disease occurs more frequently. Actively revealing of patients with primary glaucoma and their surveillance are important factors in preservation of visual function and work capacity of patients. The nurse plays an important role in primary examination and subsequent follow-up of patients.

Two main forms of primary glaucoma are distinguished, viz., open-angle and closed-angle glaucoma (see Table 4). Subjective symptoms of open-angle glaucoma are indistinct (the feeling of strain in the eye, oscillopsia). The depth of the anterior chamber does not change appreciably, trophic changes in the iris often occur. Open-angle glaucoma is characterized by slow progress of the disease with gradual change in the optic functions and development of glaucomatous excavation of the optic disc.

Classification of Primary Glaucoma  
(A. P. Nesterov and A. Ya. Bunin, 1975)

Table 4

Glaucoma	Stage	Intraocular pressure	Visual function
Closed-angle	Initial (I)	Normal	Stable
Open-angle	Developing (II)	Moderately increased	Unstable
Mixed	Developed (III)	High	
	Terminal		

Patients with closed-angle glaucoma complain of progressive impairment of sight, dimmed vision, impaired orientation in space, pain in the eye and headache. A specific complaint is halo vision (perception of a coloured halo about the light source). The course of the disease is marked by alternation of attacks and remissions. Examination of a closed-angle glaucoma patient reveals venous vascularization around the cornea, a shallow anterior chamber, dilation of the pupil, and the change in the relief of the iris.

The initial stage is not marked by specific changes in the peripheral field of vision and the marginal excavation of the optic disc (cupping) is absent. Changes in the visual field begin in the Bjerrum zone ( $10-20^{\circ}$  of the fixation point) and are manifested in the enlargement of the blind spot. Small scotomas in the paracentral region are another sign of early changes in the visual field. The scotomas are revealed during testing vision with smaller objects or by special tests (campimetry). Quantitative campimetry is the most sensitive technique used to reveal narrowing of the visual field in early glaucoma, which is more pronounced in the nasal portion (the upper nasal sector in particular).

The visual field narrows to  $15^{\circ}$  from the fixation point in the nasal portion in the developing stage of glaucoma. This stage is also characterized by marginal excavation (cupping) of the optic disc. Further narrowing in the visual field becomes concentric.

The developed stage of glaucoma is characterized by diminution of the visual field to less than  $15^{\circ}$  in at least one direction. The excavation of the optic disc is pronounced.

The terminal stage is characterized by complete blindness or by light perception alone (with incorrect projection).

### Diagnosis of Primary Glaucoma

The most effective method of diagnosing open-angle glaucoma is 24-hour tonometry. The intraocular pressure is measured two times, viz., at 6 or 8 o'clock a.m., and then in twelve hours. The early stage of open-angle glaucoma is characterized by variability of the intraocular pressure revealed by the 24-hour tonometry. In order to verify the diagnosis the hydrodynamics of the eye should be examined. Combination of pathological circadian variations with inadequate drainage of the fluids is a diagnostic sign in open-angle glaucoma.

Hydrodynamics of the eye may be examined by a compression-tonometric test, perilimbic vacuum compression of the eye or tonography.

Closed-angle glaucoma is diagnosed by a shallow anterior chamber, narrow (or closed within separate segments) angle, and goniosynechiae. The posterior ring test and some other methods are effective for diagnostication of early closed-angle glaucoma.

## Treatment of Primary Glaucoma

Treatment is mainly aimed at normalization of intraocular pressure. A 1-2% pilocarpine solution (drops) or a 2% ointment are prescribed. Pilocarpine is sometimes given together with anticholinesterase preparations (0.25% physostigmine salicylate, 0.2% phosphacol, 0.005% armine solutions, etc.). It should however be remembered that a prolonged use of anticholinesterase preparations may favour development of cataract. The dosage of the preparations depends on the form, stage and degree of compensation of glaucoma. If the patient does not tolerate pilocarpine, it can be replaced by a 3% carbacholine or 2% aceclidine solutions. Moreover, the therapy should be directed to improve trophic processes, blood circulation, etc. (nicotinic acid, vitamin PP, group B vitamins, methionine, lipocaine, ATP, etc.).

If medicamentous therapy fails or has but little effect surgical treatment is indicated.

## *Acute Attack of Glaucoma*

Emotional stress is one of the most frequent causes of an attack of glaucoma. Unpleasant sensations are especially provocative. An attack may also be provoked by medicamentous dilation of the pupil, eye strain (vision in the dark), prolonged bending, intake of much liquid or exciting medicines, and by chills. Sometimes an attack may occur without any visible cause. During an attack the patient feels strong pain in the eye and the corresponding part of the head, especially in the back of the head, the pains may be attended by nausea and vomiting, the body temperature may increase, asthenia often occurs. These symptoms may however mislead the physician in establishing the diagnosis, and an acute attack of glaucoma may be mistaken for hypertensive crisis, migraine, poisoning, etc. The patient is then directed to a therapeutic or neurological department and proper medical aid is not thus given in due time, which may become the cause of grave sequelae.

An acute attack of glaucoma is characterized by reddening of the eye, oedema of the eyelids, opacity of the cornea, dilation of the pupil, a shallow anterior chamber, increased

intraocular pressure, and "hard eyeball." Visual acuity decreases significantly. An acute attack of glaucoma should in the first instance be differentiated from acute iritis, because atropine instillations, indicated in iritis, are contraindicated in increased intraocular pressure.

### Clinical Signs Differentiating Acute Attack of Glaucoma from Iritis

Acute attack of glaucoma	Iritis
Increased intraocular pressure	Normal intraocular pressure
Diffuse opacity of the cornea, its surface is punctate	The cornea is clear, its surface is smooth
Sensitivity of the cornea is sharply decreased	Sensitivity of the cornea remains unchanged
Visible vessels of the eyeball are dilated, congestion	Predominant inflammatory injection
Shallow anterior chamber	Anterior chamber of normal depth
Pupil is dilated (compared with the intact eye)	Pupil is narrower than of the intact eye
Halo vision when the source of light is viewed	No iridescent vision
Referred pain (in the back of the head)	Pain in the eye region

### *Urgent Aid in Acute Attack of Glaucoma*

The patient with an acute attack of glaucoma should immediately be hospitalized. To abort the attack, a 1-2% pilocarpine solution should be instilled at 15-minute intervals during the first hour and then at hour intervals. In addition to the topic treatment, 0.5 g of diacarb (fonurit, diamox) is given per os. A solution consisting of 50% glycerol and 0.85% solution of table salt (physiological saline solution) is given per os (150 ml). Counter-attractive therapy should be given (hot baths for feet, mustard plasters on the back of the head).

If this fails to give positive effect within the course of 24 hours, an operation is indicated.

### *Role of a Nurse in Prophylaxis of Glaucoma*

The nurse takes an active part in mass-scale examination of the aged (over 40) population for early detection of glaucoma patients. The medical nurse (together with the physician) examines labour and living conditions of glaucoma patients. The room at work should be provided with adequate illumination. The patient is recommended to watch TV programmes in a lighted room. An emotional condition of the patient is also very important. The nurse should be attentive to the patient and treat him tactfully. Normal conditions should be provided for the patient both at home and in his office.

Liquid should be limited to a litre a day (soup included). Food should preferably be milk and vegetables. The intestinal function should be regulated thoroughly. If the patients suffer from constipations, cathartics (magnesium sulphate, Carlsbad salt) should be given.

The nurse takes an active part in health education of population. She explains the special importance of early diagnosis of glaucoma, strict adherence to the indications of the physician and the prescribed regimen.

#### *Review Questions*

- 38 At what age would glaucoma usually attack (1) under 16? (2) over 40?
- 39 What form of glaucoma is characterized by dimmed vision (1) open-angle glaucoma or (2) closed-angle glaucoma?
- 40 At what stage of glaucoma the visual field is less than 15° in at least one direction (1) initial, (2) developing, (3) developed?
- 41 Shall consumption of liquid by a glaucoma patient be limited?

## Chapter 12

# Diseases of the Oculomotor Apparatus of the Eye and the Orbit

Paralytic strabismus occurs when one or several oculomotor muscles are paralyzed (injury, infection, intoxication, etc) The eye deviates toward the intact antagonist muscle. Paralytic strabismus should be differentiated from concomitant strabismus

In order to determine secondary deviation, the patient is directed to fix the squinting eye at an object while the intact eye is screened The affected eye assumes a correct position while the intact eye will deviate This deviation is called secondary.

### Differentiation Between Paralytic and Concomitant Strabismus

Concomitant strabismus	Paralytic strabismus
Unlimited function of oculomotor muscles Absence of double vision Deviation of the squinting eye (primary) is the same as that of the other eye (secondary)	Limited function of one or several oculomotor muscles Diplopia Secondary deviation of the eye is greater than primary

A patient with paralytic strabismus should be treated by a neuropathologist and an oculist. Treatment of concomitant strabismus is aimed at recovery of binocular vision and increasing of visual acuity (at specialized ophthalmological institutions).

The main sign of the diseases of the orbit is displacement of the eye It may be abnormally protruded (exophthalmos) or retracted into the orbit (enophthalmos). A special appa-

tus exophthalmometer is used to measure the amount of exophthalmos

Inflammatory diseases of the orbit are periostitis of the orbit, phlegmona of the orbit, tenonitis (inflammation of the Tenon capsule), etc. Treatment of these diseases depends on their aetiology. Antibiotics, sulpha drugs, physiotherapy (UHF waves, quartz lamp, and diathermia) are used.

Newgrowths of the orbit may be of various aetiology as well. Characteristic signs of newgrowths are progressive exophthalmos and limited (in the direction of the tumour) mobility of the eye.

*Treatment* is as a rule surgical.



## Chapter 13

### First Aid in Injuries of the Eye

Injuries of the eye may be of various aetiology and location (affection of the appendages, of the eyeball, of the orbit) The character of the injury may also be different (wounds, contusion, burns) The eye may be injured at home and the working post

The character of visible changes does not always correspond to gravity of the injury and subsequent post-traumatic complications Other organs may also be injured together with the eye and it is necessary to examine the condition of the victim For example, the presence of nausea, vomiting, dulled consciousness are associated with concussion of the brain

Legal and other problems may arise in addition to medical, and it is therefore necessary to collect all possible information concerning the injury (time of accident, character of injury, the condition of the victim, etc ) at the site of accident.

#### INJURIES OF THE APPENDAGES OF THE EYE

Wounds and contusions of the appendages of the eye may vary from minute cuts to complete crushing of the tissues, haemorrhage in the thickness of the eyelids, subcutaneous emphysema (the presence of air in the tissues), injuries of the lacrimal glands and the lacrimal ducts.

Wounds of the eyelid may be perforating and non-perforating If the wound is arranged parallel to the ophthalmic slit, it does not open to a great extent, if the wound is perpendicular, its margins open widely, especially so if the margin of the eyelid is broken. Eyelashes or foreign objects (bristles,

small insects, etc ) sometimes enter the lacrimal punctum and irritate the conjunctiva and the cornea

**Foreign bodies of the conjunctiva** Usually these are small grains of sand, coal, stone, metal, etc , as a rule they are found under the upper eyelid, and if a person feels 'sand' in the eye, which is attended by photophobia, lacrimation, and irritation, the conjunctiva of the upper eyelid should be inspected thoroughly.

**Burns.** Four degrees of chemical, thermal, and X-ray burns of the eyelids and the conjunctiva are distinguished

Burns of the first degree are characterized by redness and swelling of the eyelid skin and hyperaemia of the conjunctiva

The second degree burns are characterized by vesication of the eyelid skin and superficial necrosis of the mucosa with easily removable whitish films.

Burns of the third and fourth degrees are attended by grave changes in the eyelids and the conjunctiva and necrosis and charring of the tissues

If the eye is injured by lime (slaked or unslaked), its particles may sometimes penetrate the conjunctiva of the eyelids and the eyeball

Burns with aniline pencil are characterized by violet colour of the conjunctiva and necrosis with deep ulceration

### **Urgent Aid in Injuries of the Eye Appendages**

Wounded eyelids are treated with brilliant green or iodine tincture, foreign bodies are removed, and the wound is washed with hydrogen peroxide Aseptic bandage is finally placed Antitetanus serum should be injected and the patient directed to the hospital

Injured eyelids require early surgical treatment (within the first 24 hours) If the injury is light (superficial, non-perforating) the eyelid may be treated in outpatient conditions The patient should be hospitalized in grave injuries

Contusion of the eyelid attended by emphysema and haematoma requires an X-ray pattern of the skull to be made to exclude fractures of the skull bones

Eyelashes should be removed from the lacrimal puncta by an epilating forceps Foreign bodies of the conjunctiva are removed by a cotton wool tampon wetted in mercuric oxy-cya-

nide solution (after anaesthetizing with a 0.5% tetracaine hydrochloride solution) If a foreign body fails to be removed by a cotton wool tampon an ophthalmic chisel or needle is used. A 10% solution of sulphamethoxypyridazine is instilled or a 1% synthomycin emulsion applied to the conjunctival sac

In cases with chemical burns, the aggressive agent is removed by prolonged irrigation with ample water (for 10-15 minutes) The eye should then be irrigated with a 2% solution of soda (in acid burns) or a 2% solution of boric acid (in alkali burns) A 30% solution of sulphacetamide should be instilled or a 1% synthomycin emulsion applied Antitetanus serum should also be given In burns with aniline pencil, its particles should be removed from the conjunctival sac and the eye washed with a 3% solution of tannic acid

Patients with moderate and grave burns should be directed to an ophthalmological department for appropriate treatment

### INJURIES OF THE EYEBALL

These injuries are divided into non-perforating, perforating, contusions, and burns Non-perforating injuries are characterized by partial injuries of the external capsule of the eye (cornea, sclera with overlying conjunctiva) Superficial (non-perforating) injuries are caused by minor foreign objects (grains of sand, emery, coal, metal, etc.) that get on the cornea or the scleral conjunctiva, or may be inflicted by a branch of a tree, snow, etc The patient feels a sharp pain in the eye, and he develops photophobia and lacrimation Minor foreign objects will be readily seen with lateral illumination Superficial defects of the cornea (erosions) become clearly visible after staining with fluorescein After a prolonged presence of a foreign body in the cornea, the area around it may become indurated The iris may also be involved in the process

#### Urgent Aid in Superficial Injuries of the Eye

Foreign bodies are removed from the cornea and scleral conjunctiva after epibulbar anaesthesia with a 0.5% tetracaine hydrochloride solution. Two drops of the preparation

are instilled in the conjunctival sac (three instillations at a 5-minute interval) Freely lying foreign bodies are removed from the cornea or scleral conjunctiva by cotton wool wetted with a mercuric oxycyanide solution (1 6 000) If a foreign body penetrates the superficial layer of the cornea, it is removed by an ophthalmic chisel or needle The eyelids are separated by the thumb and the forefinger of the left hand, while the tool is held in the right hand The foreign body should be removed together with its remains (rust, etc) Adequate illumination is required (a slit lamp should be preferred)

After removal of the foreign body, and also in cases of erosion of the cornea, a 30% sulphacetamide solution or a 10% sulphamethoxypyridazine should be instilled during 2-3 days, or an antibiotic ointment should be applied If the iris is also affected, a 0.2% scopolamine solution should be instilled to dilate the pupil

If a foreign body is held in deeper layers of the cornea a danger of corneal perforation arises, as a result of which the foreign body may get into the anterior chamber The patient should therefore be directed to an ophthalmological department where a deep seated object will be extracted

Perforating wounds of the eye are the gravest injuries. They are divided into penetrating, perforating, and those destroying the eyeball All these injuries may be inflicted by cutting or puncturing objects, fire guns, metal, and other foreign objects

A penetrating wound of the eyeball is characterized by disruption of the outer membranes of the eye (sclera and cornea) The object disrupts the eye membranes two times to form the entrance and exit wounds

The gravest wounds of the eye are caused by a heavy mechanical blow which destroys all membranes of the eye with the loss of its contents (destruction of the eye)

Penetrating and perforating wounds of the cornea and sclera are sometimes not clearly seen because the margins of the wound stick together The cornea swells quickly to close the wound The injured sclera is soon covered by the blood or conjunctiva Indirect signs of wounds should therefore be taken into account

The indirect signs of penetrating injury of the cornea are

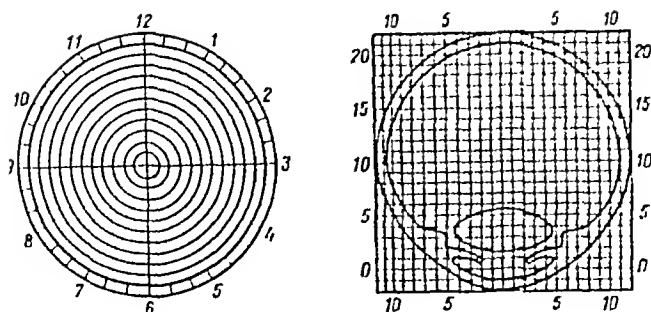


Fig 135 Baltin diagrams

a shallow anterior chamber, blood in the anterior chamber, traumatic cataract, hypotonia, decreased visual acuity

The indirect signs of a penetrating wound of the sclera are softness of the eyeball (hypotonia) due to the loss of the vitreous body, subconjunctival haemorrhage, and a deep anterior chamber.

Each third penetrating wound of the eye is aggravated by a foreign body in the interior of the eye. Therefore, in each perforating (or suspected perforating) wound, an X-ray pattern of the eye orbit should be made. The roentgenography of the eye should be done in two perpendicular projections. Frontal (facial) and lateral (profile) pictures should be made. The margins of the cornea should be marked by two drops of a thick bismuth meal (at the 12 and 6 hour points of the dial), or a Baltin prosthesis should be used. Diagrams shown in Fig 135 are used to locate a foreign object in the eye.

Intraocular foreign bodies aggravate the wound significantly. If a copper or iron fragment remains in the eye for a long time, salts of metal are formed to cause siderosis or chalcosis, which produce degenerative changes in the retina, cornea, iris, lens, and other tissues of the eye.

Perforating wounds are often attended with prolapse of the iris, ciliary body, vitreous body and other tissues, opacity of the lens (traumatic cataract) or development of intraocular infection. The latter is divided into the infection of the anterior portion of the eye (purulent iridocyclitis), of its posterior portion (endophthalmitis), and of all membranes of the eye (panophthalmitis).

The most serious complication is sympathetic inflammation

which may also occur in an intact eye (uveitis and neuroretinitis) This complication occurs most frequently in perforating wound of the other eye attended by traumatic iridocyclitis which is difficult to treat Sympathetic inflammation begins at various terms but not earlier than in 14 days following the injury

The signs of sympathetic inflammation are lacrimation, photophobia, blepharospasm, pericorneal or mixed injection, exudate around the pupil and in the anterior chamber, posterior synechiae, opacity of the vitreous body, decreased intraocular pressure, etc The disease is followed by atrophy of the eyeball

### First Aid In Perforating Wounds of the Eye

The nurse should instill a 30% solution of sulphacetamide into the conjunctival sac and give an intramuscular injection of 500 000 U penicillin An aseptic bandage should be placed and the patient urgently transported to the hospital where he will be given an X-ray study, and his wound will be surgically treated, foreign objects of the eye removed, etc An antitetanus serum should obligatory be given to patients with perforating wound of the eye

### CONTUSION OF THE EYEBALL

The eye may be contused by a blow of a fist, a ball, etc The symptoms of contusion depend on its gravity These may be oedema of the cornea or the retina, haemorrhage under the conjunctiva, into the anterior chamber, vitreous body, retina, and other tissues of the eye, disruptions of Descemet's membrane of the cornea, sclera, rupture of the iris or the pupil zone of the iris, etc, opacity of the lens (traumatic cataract) and its displacement (dislocation), detachment of the retina, and other grave affections of the eye tissues

*Treatment* The patient should urgently be delivered to the hospital A binocle bandage should be placed in grave injuries to ensure maximum rest to the injured eye The patient should remain in bed during the first 7-9 days The intraocular pressure should be measured and if it increases, 1-2% pilocarpine solution should be instilled In cases at-

tended by haemorrhage, special resolving therapy should be given. Surgical intervention is required in cases with dislocated lens, rupture of the sclera, or detachment of the retina.

### BURNS OF THE CORNEA

Four degrees of burns are distinguished. Burns of the 1st degree are characterized by superficial erosions of the corneal epithelium. Burns of the 2nd degree are also marked by affections of the upper layers of the corneal stroma. And burns of the 3rd and 4th degrees (the gravest) are characterized by necrosis and infiltration of the epithelium and own tissue of the cornea which becomes milky white.

**Urgent aid.** Causing agents should in the first instance be removed by prolonged (15 minutes) irrigation with ample water. To prevent infection, a 1% synthomycin emulsion or a 30% sulphacetamide solution should be given. Mydriatics are prescribed, and antitetanus serum obligatory given.

*Treatment* of heavy burns should be done at a hospital.

### INJURIES OF THE ORBIT

Penetrating injuries and contusions may be attended by various affections of the bones and soft tissues of the orbit. Bone fractures or foreign bodies may affect ophthalmic muscles, the optic nerve and the eyeball to cause double vision, decreased visual acuity or its complete loss. Fractures of the orbit walls may cause exophthalmos or enophthalmos. Exophthalmos is also caused by accumulation of blood and air (emphysema) in the retrobulbar space of the orbit. Injuries of the orbit may also be combined with cerebrocranial injuries, injuries of the jaws and the paranasal sinuses. Injuries of the orbit may be aggravated by infection, phlegmona of the orbit, thrombosis of the cavernous sinus, meningitis (which endangers the life of the patient), etc.

Injury of the orbit is a grave affection and thorough clinical and X-ray studies are therefore required.

*Treatment.* Patients with injuries of the orbit (with disrupted skin or mucosa) should be given an antitetanus serum (3 000 U according to Besredka). Antibiotics and sulpha

drugs should be given to prevent possible infection. Surgical treatment is indicated in phlegmona and osteomyelitis. In cases with fractures of the orbit bones and dislocation of bone fragments into the cranium or paranasal sinuses, an urgent examination of the patient by a neurosurgeon and otolaryngologist is required.

### *Review Questions*

- 42 Where will minor foreign bodies of the conjunctiva be usually found (1) in the conjunctival fornix of the upper eyelid, or (2) of the lower eyelid?
- 43 Shall a patient with a foreign body in deep corneal layers be immediately delivered to an ophthalmological hospital?
- 44 What is the minimum time during which sympathetic inflammation of the intact eye will develop (1) two days, (2) seven days, (3) 14 days?
- 45 Shall a patient with a burn of the cornea be given an antitetanus serum?

### *Answers to Review Questions*

1. Inner
2. Lateral rectus muscle
3. (1) iris, (2) ciliary body, (3) choroid
4. Yes
5. 1'
6. 50 metres
7. No
8. Rod cells
9. Myopia
10. Emmetropia or myopia
11. 1 3
12. Mydriatic solutions
13. Yes
14. Binocle
15. Yes
16. No
17. 0.5% dicaine solution
18. Yes
19. Yes
20. No



- 21 0.5%
- 22 No
- 23 Ulcerous
- 24 Negative
- 25 In hot climate
- 26 Yes
- 27 No
- 28 4th stage
- 29 In the depth of the cornea
- 30 Yes
- 31 Yes
- 32 Endogenic
- 33 Yes
- 34 Liquid tea, broth
- 35 Spasmolytics
- 36 Yes
- 37 Assisted
- 38 Over 40
- 39 Closed angle glaucoma
- 40 Developed
- 41 Yes
- 42 Conjunctival fornix of the upper eyelid
- 43 Yes
- 44 In 14 days
- 45 Yes

## Chapter 14

### Diseases of the Eye in Hot Climates

There is a special group of diseases of the eye that occur mostly in hot climates of Asia, Africa, and South America. These diseases are caused by helminths (schistosomiasis, sparganosis, filariasis, etc.), by protozoa (toxoplasmosis, leishmaniasis, etc.), by larvae of insects that invade the tissues and organs of man, the eyes included (ophthalmomyiasis), and by some other pathogenic agents. These diseases often involve serious complications in the eye and, like trachoma, glaucoma, and cataracts, can cause blindness.

The regions of spreading of many parasitic diseases among vertebrata (zoonoses) depend largely on the natural conditions (the absence of sharp variations in temperature or humidity of air and soil) that favour maturation of ova and larvae of the parasites, and on the presence of intermediate and secondary hosts (animals, insects, etc.) that are necessary for their growth. The degree to which a given area is affected by the disease depends also on the sanitary conditions of the population, the condition of the health service, wellbeing of population, their occupation and other conditions. For example, the population of rural areas is exposed to a higher risk of infection with parasitic zoonoses due to intimate contact with animals and their excrements. Wood cutters, hunters, shepherds, etc., who are exposed to contact with wild animals and insects, make groups of high occupational risk. Man often gets infected with parasites through meat, fish and other foods if they have not been boiled sufficiently long.

Medical workers should be acquainted with the main ways by which the causative agents of the diseases may be trans-

mitted This is necessary for effective health education and control of the diseases among population where the risk of infection is high

**Helminthiasis** Diseases of man caused by parasitic worms, helminths There are more than 150 nosological forms of helminthiases Cases of infection with more than one kind of helminths are not infrequent

*Schistosomiasis* These are helminthiases widely spread in Africa, Central and South America, in the Philippines, and in southern areas of Thailand

Causative agents of schistosomiasis pass in their development a very complicated route The definitive (final) host is man Worms sizing 10-26 mm parasitize in the blood of man A fertilized female lays eggs in the blood vessels of the intestine (intestinal schistosomiasis) or the urinary bladder (urinary schistosomiasis) The eggs penetrate the walls of the blood vessels and enter these organs The eggs, together with faeces and urine, are discharged in water where miracidia emerge from them The miracidia penetrate the intermediate host, the snails, in which they develop In an aqueous medium the larvae again enter the human body through the skin The conjunctiva of the eye is attacked at the first stage of invasion Along with general allergic symptoms (nettle rash), pink-yellow soft painless swellings are formed on the conjunctiva of the upper eyelid cartilage The affection spreads toward the fornix At later stages the disease involves the brain to cause finally marked disorders of vision

*Treatment* Intravenous injections of 6% solution of tartar emetic (antimony potassium tartrate) are recommended

*Prophylaxis* Bathing, swimming, laundering, etc in water reservoirs suspected for infection are prohibited Walking barefoot in the vicinity of such water reservoirs should be prohibited as well

*Sparganosis* This disease is caused by invasion of the body with larvae of a tapeworm The disease often occurs in countries of South-East Asia The primary hosts of these helminths are domestic and wild animals (cats, dogs, foxes, wolves, etc) in which the helminths are present in the small intestine Cyclops, inhabitants of water reservoirs, are intermediate hosts Frogs, fish, snakes can be intermediate hosts as well Man is a secondary host and gets infected with spar-

ganosis when he swallows cyclops with water, or contacts with snakes, frogs, etc

The patient complains of pain in the eye and excessive lacrimation, oedema of the eyelids, ptosis, and conjunctival injections. The worm often resides in a cyst-like tumour near the caruncle.

*Treatment* The disease is treated surgically the tumour containing the worm is removed.

*Prophylaxis* The main prophylactic measure is boiling potable water or its filtration. Thermal processing of fish and other foods is another important prophylactic measure.

*Filariasis* The disease is caused by invasion of man with nematode worms, filariae. The disease occurs in West Africa (Congo, Camerun). Man is the final host to these helminths in their life cycle. Insects (gadflies, mosquitoes, etc) are intermediate hosts to them.

The eye would be usually affected in patients with onchocercosis and loiasis.

*Onchocercosis* (river blindness) may be aggravated by serious diseases of the eyes such as iridocyclitis, uveitis, optic neuritis, which deteriorate drastically the visual function (to complete blindness). Using a slit lamp, the examiner can often detect microfilariae in the anterior chamber of the eye.

*Treatment* Ditrizin is used to control microfilariae. The preparation is given in a dose of 0.1 g three times a day in the course of ten days. The patient is given 2-3 courses at 10-day intervals. Adult worms are controlled by injections of a 10% suramin solution 10 ml intravenously, once a week in the course of 5-7 weeks.

*Prophylaxis* Wearing protective gauze-masks and special garments protecting from bites of insects is helpful.

*Loiasis* The disease affects the residents of coastal Africa. A filarial roundworm is found in the subconjunctival tissue of patients. The native name of the worm is Loa, hence the name loiasis. The disease would normally affect males and it is manifested by acute conjunctivitis with the presence of filariae under the conjunctiva. Most cases are attended with hyperaemia, oedema, elevated conjunctiva over the residence of the parasite. The irritation is sometimes so strong that the patient would not open the eyes. The

symptoms persist from several hours to 2-3 days and then subside. The parasite may migrate to the anterior portions of the eye and this will be the cause of relapses. More serious complications of the eye, such as keratitis, haemorrhagic retinitis, partial atrophy of the optic nerve, etc. may be associated with the presence of filariae.

*Treatment* The same preparations that are used to treat onchocercosis may be given to loiasis patients. Adult filariae should be removed from under the conjunctiva surgically after preliminary gripping the parasite with forceps.

*Prophylaxis* The same as for onchocercosis.

*Protozoiasis* Diseases caused by protozoans would normally be classified as protozoiasis.

*Toxoplasmosis* The causative agent of the infection is *Toxoplasma gondii*. The final hosts of this parasite are the animals of the cat family: domestic cat, lynx, etc. Rodents, dogs, and other animals (man included) may become the intermediate hosts. Toxoplasmosis occurs in many countries of the globe.

Two forms of toxoplasmosis affection are differentiated: congenital and acquired. Pathological changes in the eye are frequent manifestations of toxoplasmosis. Along with encephalitis and its sequelae, affections of the eye are among the most important signs of the disease.

If by the moment of childbirth the inflammatory process has already abated in the mother, the child is born with congenital toxoplasmosis and often has impaired vision and specific pathological changes in the form of vast central chorioretinal focus (pseudocoloboma of the yellow spot) with smaller foci in the vicinity which are revealed on examination of the eye bottom. Congenital toxoplasmosis may become the cause of anophthalmia, microphthalmia, nystagmus, and cataracts.

Acquired toxoplasmosis of the eye occurs usually in the young (from 11 to 40). Central chorioretinitis, which is often attended with the meningeal syndrome, inflammation of lymph nodes and high temperature, is the usual manifestation of this infection. Conjunctivitis, uveitis, disseminated chorioretinitis are also among the manifestations of toxoplasmosis.

*Treatment.* Corticosteroids in combination with sulphad-

mezone and daraprim are recommended. Sulphadimezine is given in 0.5 g doses 4 times a day, and daraprim in 0.025 g doses t.i.d. for ten days. The course is repeated for 3-4 times at ten-day intervals.

*Prophylaxis* No raw meat should be used for food. It should not even be tasted during cooking. It is especially important for pregnant. Measures should be taken to preclude feeding of cats on waste meat of slaughter-houses.

*Trypanosomiasis* African and American trypanosomiasis are distinguished. American trypanosomiasis (Chagas' disease) occurs in countries of the Central and South America. The disease is transmitted by the bug *Triatoma megista*. Signs of affection of the skin of the eyelids or the conjunctiva become apparent in two days after the bite of the bug. The eyelids are affected by tumour-like swellings, while the conjunctiva affections manifest by violet indurated oedema, enlargement of the submandibular lymph nodes and inflammation of the lacrimal gland.

African trypanosomiasis (sleeping sickness) is characterized by haemorrhagic fever, skin eruptions, lymphadenitis, cachexia, and lethargy (hence the name sleeping sickness). The disease is transmitted by the tsetse fly. The primary source of the disease are wild animals inhabiting the same regions. A red 1-2 cm nodule surrounded by whitish wax-like area (trypanosomatic chancre) develops at the site of the tsetse fly bite in 2-3 weeks. The nodule resolves in five days to leave a pigmented scar. The eyes may be affected by interstitial keratitis and iridocyclitis.

*Treatment* of the disease is symptomatic.

*Prophylaxis* Tsetse flies should be controlled by insecticides.

*Leishmaniasis* This is actually a group of transmissible protozoan diseases caused by *Leishmania* which is transmitted by the sandfly (*Phlebotomus*).

Leishmaniasis is widely spread in Europe, Africa, South-East Asia, Near and Middle East, and in South America.

Two basic forms of leishmaniasis in man are distinguished: visceral, characterized by affection of the organs of the lymphohistiocytic system, and mucocutaneous, by which the skin and mucosa are mostly affected. The eyes are also attacked. The affection is characterized by entropion, ectropion,

and other deformations of the eyelid (even destruction of the eyelids), formation of corneal ulcers with their subsequent cicatrization into leukomas which drastically affect the visual function

*Treatment* Intramuscular monomycin injections of 250 000 units 3-4 times a day for 12 days are recommended in corneal ulcers. Surgical treatment may be effective in some cases. This consists in scraping of the ulcer margins and transplantation of the cornea.

*Prophylaxis* Wearing protective gauze-masks and clothes that protect from mosquito bites is recommended.

**Ophthalmomyiasis** Myiasis are the diseases of man and other vertebrata caused by parasitic larvae of the dipterous (two-winged) insects (flies). Ophthalmomyiasis is spread among cattle breeding population of southern Europe, Northern Africa, Mongolia, China and is caused by the larvae of *Oestrus ovis* and other gadflies. Larvae of these insects are obligate parasites characterized by high activity. They may penetrate the eye to cause grave affections of its tissues (opacity of the vitreous body, haemophthalmus, detachment of the retina). Invasion of the anterior chamber of the eye with the parasites is attended by iritis and deep opacity of the cornea.

*Treatment* The upper eyelid should be turned out, the superior conjunctival fornix examined thoroughly and the larvae removed by forceps.

*Prophylaxis* Wearing protective gauze-masks and clothes is indicated. Measures to control flies should be taken.

# Subject Index

acne simplex 113  
adenoids 188

hejel 136  
binocular vision 265

candidiasis 80  
candidomycosis 80

chancre  
  hard 199  
  soft 149

cicatrix 24

compresses 43

condyloma 122

conjunctivitis 316

  alimentary 324  
  allergic 322  
  bacterial 316  
  diphtherial 319  
  epidemic 318  
  haemorrhagic 321  
  herpetic 321  
  viral 320

corium 13

cornea

  burns of 364  
  ulcer of 331

cracks 23

crusts 23

dermatitis

  allergic 97  
  herpetiformis 111  
  medicamentous 98  
  simplex 97

dermatomycosis 65  
dermis 13  
desensitizing therapy 35  
diet 49  
diphtheritis 208

ear

  anatomy and physiology of  
    225  
  examination of 230  
  external 225  
  foreign bodies of 237  
  injuries of 245  
  inner 229

earwax

  removal of 237

ecthyma 56

ectropion 314

eczema 99

entropion 313

emmetropy 268

endophthalmitis 341

epidermis 11

episcleritis 337

epithelioma 114

erosion 23

erythrasma 62

excoriation 23

eye

  anatomy and physiology of  
    247  
  growth of 247  
  injuries of 358  
    first aid in 359  
  innervation and vasculariza-  
    tion of 255  
  refraction 267



- eyeball 252
  - contusion of 303
  - diseases of 310
- eyelids 250
  - diseases of 312
- false croup 208
- favus 74
- filariasis 369
- fissures 32
- folliculitis 52
- foreign bodies of
  - eye 359
  - larynx 222
  - nose 162
  - oesophagus 222
  - trachea 222
- framboesia 136
- furunculosis 54
- glands
  - meibomian 311
  - sebaceous 14
  - sweat 14
- glaucoma 349
  - acute attack of 354
  - urgent aid in 354
  - clinical signs of 350
  - secondary 351
  - treatment of 353
- gonoblenorrhoea 318
- gonorrhoea
  - in females 140
  - in girls 141
  - in males 137
- health-resort therapy 48
- helminthiasis 368
- herpex
  - simplex 110
  - zoster 110
- hydradenitis 55
- hydrophthalmos 350
- hyperopia 268
- immunotherapy 36
- impetigo 51
- inclusion blennorrhoea 325
- infantile prurigo 104
- infusions 31
- injections 32
- intubation 216
- iridocyclitis 338
  - complications in 339
- itching diseases of the skin 103
- keratitis 333
  - deep 334
  - dendritic 334
  - herpetic 333
  - interstitial 335
- keratoconjunctivitis 323
- keratoconus 333
- keratoleukoma 336
- keratomycosis 62
  - tropical 63
- keratouveitis 335
- lacrimal apparatus 251
- larynx
  - anatomy and physiology of 198
  - examination of 201
  - foreign bodies of 222
  - scleroma of 214
  - syphilis of 214
- leishmaniasis 371
- leprosy 93
  - lepromatous 93
  - tuberculoid 93
- leucoderma 124
- lichenization 24
- lichen planus 108
- light perception 265
- loiasis 369
- lupus erythematosus 95
  - systemic 96
  - tuberculosis 89
  - vulgaris 89
- macula 20
- medicated baths 46
- melanoma 115
- microsporia 72
- miliaria alba 63
- mycoses 61
  - imbricated 63
- myopia 268

- nails 15
- nasal bleeding 167
- nasal cavity
  - examination of 160
- nettle rash 104
- neurodermatitis 103
- nodule 21
- nose
  - anatomy and physiology of 155, 159
  - foreign bodies of 162
  - injuries of 162
  - surgery of 175
- oculomotor apparatus 252
  - diseases of 356
- ointments 44
- ophthalmological patients
  - examination of 287-295
- ophthalmological tools 273-282
- ophthalmomyiasis 372
- optic nerve
  - diseases of 347
- orbit 248
  - injuries of 164
- otitis
  - external 239
  - middle 240
- ozaena 166
- papule 20
- paranasal sinuses
  - anatomy of 155
  - physiology of 159
- parapharyngeal abscesses 189
- paratonsillar abscesses 189
- paratrachoma 325
- pastes 44
- pediculosis 87
- pemphigus vulgaris 111
- perception of colour 264
  - of light 265
- pharynx
  - anatomy of 180
  - examination of 182
  - physiology of 181
  - surgery of 190
  - syphilis of 186
- physiotherapy 47
- pian 136
- pigmentation 23
- pinta 136
- pityriasis
  - rosea 109
  - tropic black 64
  - tropic yellow 64
  - versicolour 62
- plasters 45
- powders 41
- primary lesions 19
- protozoiasis 370
- prurigo, infantile 104
- pruritus 103
- pseudofurunculosis 55
- psoriasis 106
- pyoderma 54
  - superficial 51
- pyodermitis 50
- retina
  - diseases of 344
- rhininitis 163
- trichomycosis 67
- scabies 84
- scales 23
- scars 24
- schistosomiasis 368
- scleritis 337
- scleroma of the larynx 214
- scrofuloderma 91
- seborrhoea 113
- secondary lesions 23
- shimbery 63
- sinuitis 170
- skin
  - anatomy of 11
  - care of 18
  - erosion of 23
  - excoriation of 23
  - layers of 11
  - malignant tumours of 114
  - physiology of 16
  - tuberculosis of 89
  - ulcers of 23
- skin diseases
  - causes of 27
  - endogenic 28

- skin diseases
  - exogenic 27
  - desensitizing therapy of 35
  - diagnosis of 25
  - external treatment of 40
  - itching 103
  - occupational 102
  - symptoms of 19
- soaps 46
- soft chancre 149
- spots 20
- strophilulus 104
- sulpha drugs 39
- surgery
  - of nose and paranasal sinuses 175
  - of pharynx and nasopharynx 190
- sweat glands 14
- sycosis 53
- syphilids
  - gummatous 125
  - nodular 125
  - pigmented 124
  - pustulous 122
- syphilis 116
  - congenital 126
  - of larynx 241
  - of pharynx 186
  - primary 120
  - secondary 121
  - tertiary 124
- tonsillitic 184
- toxicoderma 97
- toxoplasmosis 370
- trachea 198
  - anatomy of 198
  - examination of 201
  - foreign bodies of 222
- tracheostoma 211
- tracheotomy 217
- trachoma 327
  - complications in 328
- treponematosi, tropic 135
- trichomoniasis 148
- trichophytosis 68
  - chronic 70
  - superficial 69
  - zoophilic 71
- trypanosomiasis 371
- tubercle 20
- tuberculosis of the skin 89
- ulceration of the skin 23
- urticaria 104
- vegetations 24
- venipuncture 30
- vesicles 21
- vision
  - binocular 265
  - peripheral 261
- visual acuity 257
- vitamin therapy 37

